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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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Corrosion of Cast Iron in Air and Water

We have previously referred to the work of a Committee of the Institution of Civil Engineers which, over a period of some fifteen years, studied the deterioration of structures in sea water. Since 1920 some fourteen progress reports have been issued, and the fifteenth takes the form of a book issued by the Stationery Office describing the work to date. We can pass over the work on timber, concrete and on the use of preservatives like paints on steel, and refer to the section on steel and iron. Some fourteen materials were tested, three wrought irons, four ordinary steels, two cast irons, and five special steels. The cast irons represented hot-blast and cold-blast iron, as experience seemed to show that the latter type resisted corrosion better than the former. It is rather unfortunate that no indication is given of the origin of the two irons. The cold-blast iron is the more typical, having a total-carbon content of 3.4 per cent., and silicon 1.7 per cent. The hot-blast iron, however, is given the rather unusual analysis of 2.87 per cent. total carbon, 2.34 per cent. silicon, with 0.848 per cent. phosphorus. The manganese is low, 0.27 per cent., and sulphur 0.104 per cent., which is probably responsible for the high combined carbon of 1.01 per cent. No information is given whether the material was tested in the form of pig or in the form of cast bars, and, if the latter, whether the composition was modified by the use of scrap. The unusual low carbon content of the hot-blast iron to some extent upsets the comparison intended between the two materials. It is assumed that the bars were cast from remelted pig, the casting skin being left on.

The conclusions recorded state that the cast irons in the aerial tests resisted corrosion exceedingly well, in most cases comparing very favourably with the 13.5 per cent. chromium steel and the 36 per cent. nickel steel. What advantage there was between them was in favour of the cold-blast iron. In the immersion tests in fresh water, there was a little corrosion beneath the surface after ten years. Under half-tide and complete immersion in sea-water tests, corrosion penetrated very seriously into the metal. In one case, corrosion penetrated through a crack or pore into an internal casting flaw. There is no doubt that corrosion penetrated via the graphite voids. It may be added that the range of materials tested showed maximum differences in the air and fresh water tests. Their behaviour was much more alike in the half-tide and complete immersion tests. Copper additions to mild steel increased resistance to aerial and fresh-water corrosion, but the advantage did not appear to be maintained in the half-tide and complete immersion tests. The 36 per cent. nickel steel was the most resistant of all the materials tested.

The Glasgow Conference

The Conference of the Institute of British Foundrymen which was held in Scotland last week, under the presidency of Bailie H. Winterton, well maintained the high level which is always associated with the annual manifestations. The local civic, commercial, industrial and academic authorities all lent their support and the success achieved undoubtedly owes much to their enthusiastic co-operation. The social side was excellent; there was plenty of music and dancing, whilst the visit to the Scottish War Memorial and Edinburgh Castle was a much appreciated innovation. The trip down the Clyde was favoured with brilliant weather.

The Papers submitted were of outstanding value, especially Mr. Judson's contribution, which dealt with the two-cupola process. More than one foundry is repeating the experiments described, as the results indicated point to some notion of auto-inoculation. The discussions never flagged for a moment, and there was much evidence that other members might have joined in, had time allowed. It is to be hoped that they will take advantage of the request made to send in their remarks to the secretary for inclusion in the report.

The works visits were so well appreciated that some members thought that another half day might usefully have been squeezed into the programme, even at the expense of some social function. The thanks of the Institute are due to those enlightened firms who opened their works for inspection.

The organisation, in the capable hands of Mr. J. Bell, assisted by Mr. A. Campion, Mr. Frank Hudson and Mr. D. Sharpe (chairman of the Executive Committee), was faultless.

The new President, one of the first members to join the Institute, must be happy in the knowledge that its affairs are in every way satisfactory; that it is regarded with envy by sister organisations on account of the general enthusiasm of its members, and that he can rely on a full measure of support from every member. May he and Mrs. Winterton enjoy good health for his term of office, which is doubly arduous for those, like the new President, who live at a terminal seat of activity.

Golden Wedding of a Popular Foundryman

The golden wedding celebration of Mr. and Mrs. J. McClelland, held at Newport last Saturday week, was a very happy affair, and took the form of a supper and dance. As one might expect from so enthusiastic a member of the Institute of British Foundrymen, Mr. McClelland chose to invite the members of the local Branch to join in his evening's entertainment. Mr. Southcott (Briton Ferry), as Branch-President, was invited to act as chairman, and after the guests had been received by Mr. and Mrs. McClelland, all partook of supper.

After the loyal toast, the chairman called upon the party to drink to the health of the "Bride and Bridegroom," which was accorded musical honours. Then Mr. C. E. Williams, J.P., presented a silver salver as a mark of appreciation of the members of the branch; whilst Mr. J. P. Galletly, of Cardiff, presented an autograph album bearing the signature of every member of the branch, and Mr. Southcott presented a cheque. Telegrams of congratulation were received from various parts of England and Wales, one being from the Editor of THE FOUNDRY TRADE JOURNAL.

Messrs. C. E. Richards, R. J. Richardson, W. Williams, R. G. Williams, and W. S. Kinsman all paid tribute to the untiring efforts of Mr. McClelland and to the unselfishness of his wife. Their sincere tributes touched Mr. McClelland, particularly when references were made to "one who had been such a good partner for the last fifty years." In lighter vein, he recalled the changes in fashion, causing amusement particularly among the ladies present. He concluded by asking another couple present, "who had evidently been doing the same sort of thing at the same time," to accept a basket of flowers in appreciation of the friendship extended to his youngest daughter, Mrs. Rawden. The basket was a small edition of the gold flower basket as presented to the Duke and Duchess of Kent by the South Wales Blind on the occasion of their wedding.

Mr. and Mrs. McClelland's three daughters were all able to be present at the function, Mrs. C. S. Gibbons, of Blundellsands, coming with her husband and daughter, Mrs. T. Weale Chapman, of Loughton, and Mrs. Ethel Rawden, of Newport.

Catalogue Received

Cleaning by Abrasives. The Pangborn Corporation, of Hagerstown, Maryland, U.S.A., have sent us a sixteen-page catalogue of an abridged character, which deals with the airless "Rotoblast" system as applied to tables, barrels, cabinets and special-duty machines. Of the last-indicated type, an installation is shown engaged upon the cleaning of lawn-mower parts. Dust-collecting blast rooms, barrels, tables and cabinets are all dealt with in turn, but of exotic interest to the British foundry executive is a short illustrated description of the high-pressure water system. The catalogue is available to our readers on request.

Coal-burning Appliances

The Coal-Burning Appliances Joint Consultative Board held its second meeting in London recently, with Colonel Greenly in the chair. It was reported that Mr. H. Teeling Smith, of Smith & Wellstood, Limited, had taken the place of Mr. Mirams, who had retired from the Board, and that the representation of the Coal Utilisation Council had been completed by the appointment of Mr. P. O. Roberts, of Peake, Oliver & Peake, Limited, and Mr. D. E. Havinden, chief publicity manager of the Council.

District Presidents.—No. 3

WALES AND MONMOUTH BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN

MR. SIDNEY SOUTHCOTT, the new President of the Wales and Monmouthshire Branch of the Institute of British Foundrymen, is a native of Briton Ferry, Neath. He received his education at the local National Schools, and continued his studies at the technical classes of the Glamorgan Education Committee. He began his career as an apprentice under the Glyncorrwg Railway Company, followed by experience with the Baglan Engineering Company, Limited, serving four years in their ingot-making department. He afterwards entered the service of his present employers, Taylor & Sons, Limited, of Briton Ferry, sole patentees and makers of the well-known "Taylor" pickling machine and

MR. S. SOUTHCOTT.

other specialities for the tinplate, sheet and steel trade. In 1927 he was appointed to his present position of manager of the ferrous and non-ferrous foundries. He is author of several technical Papers published in THE FOUNDRY TRADE JOURNAL, and has delivered lectures before several branches of the Institute.

Mr. Southcott joined the Institute of British Foundrymen in 1927, and soon reached the Branch Council. In 1929-30 he was awarded the diploma of the Institute following his digest on "Moulding and Suggestions on Gating," Messrs. Taylor signalising the honour by presenting the recipient with a gold watch. He entered public life in 1919 as a member of the Briton Ferry Urban District Council, and was subsequently elected to a seat on the Neath Town Council, into which the former council had been merged. A keen sportsman, Mr. Southcott is Chairman of the Briton Ferry Town Cricket Club, Vice-Chairman of the South Wales and Monmouthshire Cricket League, and Trustee of the Briton Ferry Welfare Association.

(*Concluded from next column.*)

predicted to win was a non-starter. Yet being wise men we will take good note of its name and invest twice the number of silver pieces on its next appearance."

Moral.—Wait for the next appearance.

P.S.—Additional moral: It's miles better to run a Conference sweepstake.

MARKSMAN.

Random Shots

Among the *young bloods* attending the Glasgow Conference was a German *nipper*, two *sons* of *Jud and Simp.* from the U.S.A. and *more guys* from South Africa. From a Belgian point of view this must sound *apaulingly Fassotious.*

* * *

Of the 537 speeches made at the Conference—if you don't believe "Marksman" you should have counted them yourself—the best was made by Mrs. Hurst, impromtu, when she thanked those who had presented her with a silver tea set. The *ad hoc* invitation to tea issued might be embarrassing for Jimmy, when on a Sunday afternoon he is just working out the last phases of a research into the elastic hysteresis properties of some pseudo-cold-blast pig-irons as modified by increasing additions of niobium, caesium tellerium and haggis, and a Rolls Royce, two motor coaches and a pre-war Ford arrive at Lichfield and demand the implementation of the implied agreement. Such things happen in America, but there they have the decency to bring their own provisions and pocket flasks.

* * *

On inquiry at the Bureau of the Conference "Marksman" was officially informed that the only delegate who consistently forgot to bring his book of tickets was the gentleman who for the past ten years has undertaken the organisation. He had so little to do that he became lyrical and broke into verse. This is one of his best efforts:—

"There was a young lady of Nantes
Who went for a hike in short pants.
She sat on a hill
But couln't keep still
For the hill was infested by ants."

T. M.

Not to be outdone, "Marksman," inspired by the day after the night before, compiled this effort:—

"At big Scottish 'feeds' there's a fault,
Pipers pipe, Haggis comes, then a halt,
But gastronomes state
The terrible fate
Of those who mix wine with the malt."

* * *

A MODERN FAIRY TALE.

Once upon a time, a large party of wise men, bearing emblems of the Wars of the Roses, visited the great metropolis, and it came to pass that during the journey they encountered a prophet and this prophet told them that being occupied in private life as a trainer of race-horses, he was already aware of the winner of the two-thirty. Approaching their journey's end, they lit upon a hostelry and being anxious to capitalise the sage's advice, the wisest of the wise men toured the environs of the inn and from the assembly of unemployed artificers chose one with a nice kind face whom he addressed thus: "We shall return to this place at five minutes past five. Here are ten pieces of silver, and here a slip. On it is writ the name of the winner of the two-thirty." The artificer said: "You are well met, I am myself a bookmaker by trade, and hail from the County of the Red Rose. Great will be my pleasure to return to you not ten but 50 pieces of silver." Punctually at the appointed hour the caravanserai stopped at the sign of the Chess Board, but in the interim a great trade revival had supervened and the artificer had found evening employment as a maker of chariots at a neighbouring smithy. Being of but poor intellect, unlike the wise men from the North, he had forgotten the meeting at the sign of the Chess Board.

The wise men from the County of the Red Rose took council amongst themselves, saying one to another: "It matters but little, because the sage's prophecy was ill-founded. The horse he

(*Concluded in previous column.*)

INSTITUTE OF BRITISH FOUNDRYMEN

THIRTY-THIRD ANNUAL CONFERENCE AT GLASGOW

ANNUAL GENERAL MEETING

The annual meeting of the Institute was held in the Grosvenor Restaurant, Gordon Street, Glasgow, on Tuesday evening, June 9, with the retiring President, Mr. J. E. Hurst, in the Chair.

The minutes of the annual general meeting held at Sheffield on July 2, 1935, were taken as read, approved, and signed by the President.

The Annual Report of the Council for the session 1935-36 was presented.

ANNUAL REPORT

This report covers the period May 1, 1935, to April 30, 1936, and the accounts are for the year ended December 31, 1935.

In the last Annual Report a small decrease of membership was reported; it is satisfactory to note that this decrease has been more than neutralised, and on April 30 the membership showed a net increase of 112. The total number of new members added during the year is 265 and the loss due to deaths, resignations and other causes is 153. This increase is due, partly to the improved trade conditions, also to the increased regard in which the Institute is held throughout the industry.

Table I shows the changes in membership and an analysis of the present membership is given in Table II, the figures for the previous year being given in brackets as a comparison.

His Majesty King George V

A resolution of sympathy was forwarded on behalf of the members of the Institute to Her Majesty Queen Mary, and Her Majesty graciously acknowledged receipt of this message.

Honours Conferred upon Members

Among the honours which have been conferred upon members of the Institute are the following:—

Sir Robert Hadfield, Bart., has been awarded the Albert Medal of the Royal Society of Arts "for his researches in metallurgy and his services to the steel industry," and has also attained the Diamond Jubilee of his connection with the firm of Hadfields, Limited.

Mr. Vincent Delport has been elected Vice-President of the International Committee of Foundry Technical Associations.

Mr. G. T. Lunt was re-elected President of the Foundry Trades Equipment and Supplies Association.

Dr. A. M'Cance was re-elected President of the Glasgow and West of Scotland Iron and Steel Institute, this being the fourth successive year that Dr. M'Cance has occupied this position.

Mr. J. A. Thornton has been re-elected President of the Manchester Association of Engineers.

Mr. E. R. Walter has been elected President of the Lincoln Engineering Society.

Mr. A. Edwards has been elected a Member of Parliament.

Deaths

It is with great regret that the Council reports the death of 16 members, amongst whom are several who have been prominently identified with the Institute for a number of years, including:—

The Right Hon. Arthur Henderson, M.P., who was elected an Honorary Member of the Institute in 1926. Mr. Henderson was identified with the foundry industry for most of his life, and was a notable figure in public life, having held office as President of the Board of Education, Home Secretary, Foreign Secretary and President of the Disarmament Conference. He was awarded the Nobel Peace Prize in 1935.

Mr. F. W. Finch, who died at the age of 89, was one of the founders of the Institute, and for some years was Secretary. He then became Honorary Treasurer, a position which he held for a period of twenty-five years. He was awarded the Meritorious Service Medal of the Institute in 1933.

Mr. T. Wilkinson, a prominent member of the Middlesbrough Branch, and a former Mayor of Stockton-on-Tees.

H. WINTERTON
(President of the Institute).

Mr. F. Biggin, who for many years was intimately associated with the Sheffield Branch.

Mr. C. W. Kent, who had been a member of the Council of the Lancashire Branch, and was elected a member of the Council of the West Riding of Yorkshire Branch for a short time before his death.

Mr. W. J. Flavell, J.P., a Past-President of the Birmingham Branch and a representative of the Institute on Committees of the B.S.I. and the City and Guilds of London Institute.

The Council also note with regret the death of Mr. B. H. Johnson, Vice-President of the American Foundrymen's Association, who was well known to many members of this Institute.

Finances

Referring to the Balance Sheet and Income and Expenditure Account, the report states that increases have been necessary in certain items of expenditure due to increasing activities, on the other hand there have been economies in other items, particularly in the expenses of the Branches, and the Council wishes to express its thanks to the Branch officials for their endeavours to manage their respective Branches as economically as is consistent with efficiency. There has been an increase of income due to a large amount of arrears of subscriptions having been recovered during the year, and also to increased membership. In spite of the increased expenditure, the excess of income over expenditure was £166 18s. 4d.

During the year £300 was invested from the surplus funds in 3 per cent. Funding Loan. The cash at the bank, namely, £389 9s. 8d., includes the sum of £117 9s. 8d. transferred from the surplus funds in the hands of the Branches.

A special Sub-Committee has closely investigated every item of income and expenditure, and the Council has no hesitation in reporting that the expenditure is under very close control and constant review. Although the financial position is satisfactory, the Council is conscious of the necessity of continuing to exercise a policy of wise economy.

Board of Development

In the autumn of 1935, the Council agreed on the suggestion of the President to the appointment of a Development Committee, which consists of the Executive Committee and a number of additional members. The function of this Committee is to review the whole field of the Institute's work and to recommend improvements and new developments. An important report dealing with the annual volume of "Proceedings" and other Technical publications of the Institute has already been submitted by this Committee to the Council, and is under consideration at present.

Sheffield Conference

The Thirty-Second Annual Conference was held in Sheffield from July 2 to 5, 1935. On the evening of July 2, members and ladies were entertained to a Reception in the Town Hall by the Lord Mayor of Sheffield, Alderman P. J. M. Turner, and the Lady Mayoress, Mrs. Turner.

At the opening meeting of the Conference on July 3, members were welcomed by the Lord Mayor of Sheffield; the Master Cutler, Mr. A. Williamson and the President of the Chamber of Commerce, Mr. A. K. Wilson. Mr. J. E. Hurst was installed President in succession to Mr. Roy Stubbs, and Messrs. H. Winterton and C. W. Bigg were installed respectively, to the offices of Senior and Junior Vice-President.

The thanks of the Institute are tendered to the Lord Mayor of Sheffield and the Lady

TABLE I.—*Changes of Membership.*

	Subscribing firms.	Members.	Associate members.	Associates.	Associate students.	Total.
At April 30, 1935	49	729	901	98	3	1,780
Additions and transfers from other grades	3	85	114	47	16	265
	52	814	1,015	145	19	2,045
Losses and transfers to other grades ..	3	36	89	25	—	153
At April 30, 1936	49	778	926	120	19	1,892

Mayoress; to the firms who arranged visits for members and ladies; to the staffs of those firms; to the authors of Papers; to the President, Mr. Hurst and Mrs. Hurst, who entertained the members and ladies at a garden party; and to all who subscribed to the funds or assisted in the organisation of the Conference.

The Council wishes particularly to record its indebtedness to the Council and members of the Sheffield Branch who were responsible for the organisation of the Conference; to the Branch-President, Mr. A. Whiteley; to Mr. T. R. Walker, Secretary of the Branch and to Mrs. Walker, Secretary of the Ladies' Committee.

TABLE II.—*Analysis of Membership, April* 30, 1936.

Branch.	Subscribing firms.	Members.	Associate members.	Associates.	Associates (students).	Total.
Birmingham	3 (3)	121 (108)	124 (117)	16 (14)	4 (—)	268 (242)
East Midlands	3 (3)	49 (44)	82 (85)	5 (3)	—	139 (135)
Lancashire	14 (15)	111 (119)	213 (228)	31 (27)	—	369 (389)
London	6 (5)	171 (147)	97 (73)	6 (8)	1 (—)	281 (233)
Middlesbrough	—	20 (21)	34 (38)	5 (7)	—	59 (66)
Newcastle	7 (6)	31 (28)	30 (26)	44 (21)	9 (—)	121 (81)
Scottish	4 (5)	95 (86)	183 (180)	8 (11)	1 (—)	291 (282)
Sheffield	6 (6)	82 (81)	57 (60)	3 (5)	1 (—)	149 (152)
Wales and Mon.	2 (2)	32 (30)	33 (28)	—	3 (3)	70 (63)
W. R. of Yorks	3 (3)	43 (38)	62 (62)	2 (1)	—	110 (104)
Unattached	1 (1)	23 (27)	11 (4)	— (1)	—	35 (33)
	49 (49)	778 (729)	926 (901)	120 (98)	19 (3)	1,892 (1,780)

Edward Williams Lecture

The Edward Williams Lecture was established to commemorate the very successful year of office as President of Mr. C. E. Williams. The first lecture was delivered on the opening day of the Sheffield Conference, on July 3, by Sir Wm. J. Larke, K.B.E., on the subject of "Man and Metal." The second Edward Williams Lecture will be delivered during the Glasgow Conference on Thursday evening, June 11, by Professor A. L. Mellanby, D.Sc., and the subject will be "Cast Iron."

Other Technical Organisations

The Institute continues to maintain close relations with other organisations, particularly those serving the engineering industry. Several of the Branches arrange joint meetings with the local Branches of these organisations from time to time. The Institute takes an increasingly close interest in standardisation work, and is represented on most of the important British Standards Institution Committees which are of interest to the foundry industry.

British Cast Iron Research Association

Important investigations in progress at the present time include shrinkage and contraction of cast iron, the formation of graphite (to be dealt with in part in a Paper to the Glasgow Conference), synthetic moulding sands, metallurgical coke and alloy additions to cast iron.

On development work the number of practical problems dealt with on behalf of members is approximately four per working day. Over one hundred Balanced Blast cupolas have been installed in this country and an additional number overseas, and the furnace is found in the works of about 20 per cent. of members. Apart from other advantages, the resulting economies in fuel are estimated to reach, on a conservative estimate, over three times the total industrial income received.

The report presented at the annual meeting of the Association in October, 1935, indicated that the year 1934-35 had been a record, the total income exceeding £13,000 for the first time. To do this the industrial income had been raised by extension of membership and the £300 remaining to make up the minimum of £7,000 required to earn grant of £5,000 was made up by a group of members in addition to their normal subscriptions. Further efforts are being made during the current year to ensure the necessary minimum being reached entirely by way of annual subscriptions, and the membership of all firms in the industry is sought, in the belief that firms who make full use of the services available will find membership an economical proposition.

Foundry Exhibition

By courtesy of F. W. Bridges & Sons, Limited, the organisers of the Shipping, Engineering and Machinery Exhibition, in conjunction with which the Foundry Exhibition was held in September, 1935, the Institute was permitted to organise a stand which was in charge of the Technical Committee and to which further reference is made in the Technical Committee's report. Appreciation is hereby expressed to Messrs. Bridges for this courtesy, for their invitation to the members of the Council to luncheon and their further invitation to the whole of the members of the Institute to tea.

British Industries Fair

Thanks are tendered to the Birmingham Chamber of Commerce who kindly invited the members of the Council to lunch at the British Industries Fair on February 27.

Relations with Overseas Associations

The International Foundry Conference in 1935 was a European conference and was held in Brussels in the buildings of the Universal Exposition. Over twenty countries were represented and some thirty-five members and ladies of the Institute of British Foundrymen represented Great Britain, headed by the President, Mr. J. E. Hurst, and the Senior Vice-President, Mr. H. Winterton.

The Council takes this opportunity of thanking Mr. J. Leonard, President of the Association Technique de Fonderie de Belgique, and the members of this Association for their very sincere hospitality and for the many courtesies which were shown.

A meeting of the International Committee of Foundry Technical Associations was held in Brussels during the Conference and was attended by the President and Mr. V. C. Faulkner, representing Great Britain, also by Mr. T. Makemson as Secretary of the Committee and Mr. V. Delport, the European representative of the American Foundrymen's Association. At this meeting Mr. J. Leonard, who is an Honorary Member of this Institute, was elected President for the year 1936, and Mr. V. Delport was elected Vice-President.

A meeting of the International Committee on Testing Cast Iron was also held in Brussels during the Congress, and the Institute was represented by Dr. A. B. Everest and Mr. T. Makemson.

The next International Foundry Conference will be a world conference, and will be held in Düsseldorf from September 17 to 22, 1936. Arrangements will be made for a party of members and ladies to attend this conference, and further details will be circulated to members of the Institute later.

Mr. H. H. Beeny was the author of the official Exchange Paper presented to the International Foundry Congress in Brussels, and Mr. P. A. Russell presented the official Exchange Paper to the French Foundry Congress in Paris, which was held in connection with the International Congress of Mines, Metallurgy and Applied Geology.

Exchange Papers to forthcoming Overseas Conferences will be presented as follow:—

American Foundrymen's Association, Detroit—The President, Mr. J. E. Hurst.

French Foundry Conference, Lille—Mr. G. L. Harbach.

International Foundry Conference, Düsseldorf—Mr. J. G. Pearce.

At the Institute's forthcoming Conference in Glasgow in June, Papers will be presented on behalf of the American, French, and German Foundry Technical Associations.

Branch Activities

It will be seen from a perusal of this and previous reports, that the Institute is becoming increasingly interested in various movements of a national character, designed to promote the technical development and educational progress of the foundry industry. The Council, however, is fully conscious of the great importance of the work which is done throughout the year by the various Branches and realises that the only contact which many members make with the Institute, is through the work which the Branches carry out. The officials of the Branches, particularly the Honorary Secretaries, give much devoted service and it is with great pleasure that the Council records its thanks to them for those services.

During the year, about one hundred Papers have been presented at various Branch meetings and in addition there have been several discussions and also the annual addresses of the Branch-Presidents.

Thanks are also expressed to the proprietors and staffs of the various works which the Branches have visited, to the authors of all Papers given to the Branches and to the firms with whom they are associated.

A two days' meeting of the London and East Midlands Branches was held for the second successive year, on this occasion at Derby and Loughborough and was well attended.

Educational Work

The educational work for which the Institute has been responsible, or in which it is actively interested, is of a graduated character intended to cover the requirements of various types of persons engaged or about to be engaged in the trade. This work includes:—

(*a*) The encouragement of the establishment of part-time evening classes in patternmaking and foundry practice, arrangement of examinations and the award of certificates which are endorsed by the President. This work is carried out by the City and Guilds of London Institute through a Committee on which the Institute of British Foundrymen is largely represented; the results of the 1935 examinations are as follows:—

	No. of candidates.	Pass 1st class.	Pass 2nd class.	Percentage of passes.
Patternmaking— Intermediate grade	29	5	11	55.2
Patternmaking— Final grade	21	6	8	66.6
Foundry Practice and Science	61	13	21	55.7

Prizes were awarded to:—

PATTERNMAKING—INTERMEDIATE GRADE.

Mr. W. Brindley, of Wolverhampton, Bronze Medal of the C. & G. of London Institute.

PATTERNMAKING.—FINAL GRADE.

Mr. J. C. Wall, of Coventry, Silver Medal of the C. & G. of London Institute, and Buchanan Prize of the Institute of British Foundrymen.

Mr. H. W. Carter, of Poplar, Buchanan Prize.

Mr. L. Harrop, of Huddersfield, Buchanan Prize.

Mr. W. Watson, of Coventry, Buchanan Prize.

FOUNDRY PRACTICE AND SCIENCE.

Mr. J. Scobbie, of Derby, Bronze Medal of the C. & G. of London Institute and Buchanan Prize of the Institute of British Foundrymen.

(*b*) The endorsement in respect of special foundry subjects by the President of the Institute, of National Certificates in Mechanical Engineering, issued by the Board of Education and the Institution of Mechanical Engineers. During the last twelve months 33 National Certificates have been so endorsed, making a total of 136 since the commencement of the arrangement.

The National Certificate courses are intended for young men who are prepared to take longer and more advanced courses in order to fit them for positions of responsibility.

(*c*) The Degree Course at the Sheffield University, which is intended for the increasing number of young men who wish to have a University degree before entering the foundry industry. This course is now in its second year, and a number of students are enrolled in the course.

The initial funds for the commencing of the course were raised by a Committee of this Institute, which, having completed its work has now been dissolved. Further funds are required, and an advisory Committee formed by the University of Sheffield upon which the Institute is represented, will now be responsible for advising on the Course and for the raising of further funds.

In addition to the foregoing, the Council wishes to call attention to the valuable work being done by the British Foundry School at Birmingham, established through the efforts of the British Cast Iron Research Association and Mr. Pearce.

The School, which is a specialised course of one year's duration for men of practical experience in the industry and suitable preliminary education, who wish to equip themselves for the highest posts in the industry, opened in October, 1935, with thirteen students. Mr. J. Bamford, B.Sc., was appointed Lecturer-in-Charge and over one hundred lectures have been given by outside specialists in the industry. Foundry visits are paid each week. The diploma examination will be held in July and entries of students for the second year, commencing in September, 1936, can now be made. The President, Mr. J. E. Hurst, represents this Institute on the governing body, which is formed of representatives of the dozen or so institutions supporting the scheme, together with representatives of the Board of Education and Birmingham Education Committee. The income required for the first year's working has been raised, the financial year ending in April, 1936, and it is hoped that the School will become permanent.

There are now in operation courses suitable for all grades of workers in the foundry trade, and the Council appeals to all those who have young men under their control to encourage them to take advantage of these educational facilities, further particulars of which can be obtained from the Secretary of the Institute.

Awards

No award was made of the Oliver Stubbs Medal in 1935. The rules have now been amended to permit of the award being made for services over a longer period and not necessarily service given during the previous year.

Meritorious Service Medal

The third award of this Medal was made in July, 1935, to Mr. H. Bunting, who had recently retired from the Secretaryship of the East Midlands Branch after twenty years' devoted work in that capacity.

Diplomas

The announcement of the award of Diplomas to the following members was made at the Sheffield Conference. The Diplomas were given in each case, for Papers given before Branches which are named in the list:—

W. H. Bamford, Birmingham Branch.

W. Machin, Lancashire Branch (joint Paper with M. Oldham, who was then a non-member).

J. Roxburgh, Sheffield Branch.

P. A. Russell, London and E. Midlands Branches.

T. Tyrie, Scottish Branch.

T. R. Walker, Sheffield Branch.

C. W. BIGG

(*Senior Vice-President of the Institute*).

Surtees' Memorial Examination

The 1936 examination was held by the Scottish Branch, and the results were:—

Matthew Russell, *Gold Medal.*

Douglas Robertson, *Silver Medal.*

Employment Bureau

The Employment Bureau has been the medium by which a large number of members have found suitable employment, though it has not always been possible to find men with the type of experience required by the inquiring employers. It is satisfactory to note that due to improved trade conditions, a lesser number of members are disengaged.

The Institute is indebted to the proprietors of THE FOUNDRY TRADE JOURNAL for the facilities they give in connection with the Employment Bureau.

Council

Four meetings of the Council and more than twenty meetings of standing and special Committees have been held. The Council Meetings have been at Sheffield, Newcastle, London, and Middlesbrough, the average attendance being 42.

The Technical Committee has held four meetings and there have been two meetings of the Technical Council. Additionally, upwards of 40 meetings of Sub-Committees of the Technical Committee have been held.

The Council of the Institute consists of:—

(*a*) *Ex-officio* members, *i.e.*, the President, Vice-Presidents, Past-Presidents, Branch-Presidents, and Branch Secretaries.

(*b*) Members elected by the Branches.

(*c*) Members elected by ballot by the whole of the members of the Institute.

The last named are ten in number, of whom five retire each year; the five who so retire at the Annual General Meeting on June 9 are:—

Messrs. A. Campion, J. W. Gardom, B. Hird, R. A. Miles, J. M. Primrose.

All these gentlemen are eligible for re-election for a further period of two years, and offer themselves for re-election.

The Council wishes to express its grateful thanks for the services of Mr. W. B. Lake, J.P., Honorary Treasurer, whose guidance in connection with the Institute's finances has been invaluable, and to Mr. J. W. Gardom, Convener of the Technical Committee.

Annual Conference

The thirty-third Annual Conference will be held at Glasgow from June 9 to 12, 1936, when Mr. H. Winterton (President-elect) will be installed President of the Institute.

J. E. HURST, *President.*

T. MAKEMSON, *Secretary.*

Adoption of Report

In proposing the adoption of the Report the PRESIDENT mentioned that last time the Conference was held in Glasgow 11 years ago, the membership of the Institute numbered 1,525, while this year it numbered 1,892.

MR. R. A. MILES seconded, and the report was unanimously adopted.

Balance Sheet and Accounts

On the motion of MR. W. B. LAKE, the Hon. Treasurer, seconded by MR. VICTOR STOBIE (Past-President), the Balance Sheet and Accounts were unanimously adopted.

Report of Technical Committee

MR. J. W. GARDOM, Convener, proposed the adoption of the Technical Committee's Report, which was seconded by MR. C. E. WILLIAMS (Past-President).

MR. DANIEL SHARPE (Scottish Branch-President), in commenting on the Report recalled that it was suggested at the last meeting at Middlesbrough that the two Papers referred to in the Report should become the subject of discussions at one meeting during the forthcoming session, and he thought it would be worth while giving some consideration to that suggestion. He thought they might profitably have a discussion night during the forthcoming session in connection with each Branch.

The Report was unanimously adopted.

FOURTH ANNUAL GENERAL REPORT OF THE TECHNICAL COMMITTEE

The Technical Council consists of certain *ex-officio* members of the Technical Committee together with two members elected by each Branch of the Institute; the Technical Committee consists of the Technical Council together with a number of members who are co-opted by reason of their special knowledge of the work covered by one or more of the sub-committees of the Technical Committee.

During the year some reorganisation has taken place with regard to the meetings of this Committee. It has been realised that the important work is done by the various specialised sub-committees, and in order to prevent encroachment upon the time available for the meetings of these sub-committees, the meetings of the full Technical Committee have been shortened considerably and meetings of the Technical Council are now held only occasionally, instead of one per

quarter as was the previous arrangement. The benefit of this arrangement has already been seen, in that the Sub-Committees are able to give more consideration to the details of the work which they have in hand and more rapid progress is being made. Details of the work of each sub-committee are given in the sub-committee reports which follow this report.

Additional to the Sub-Committee work, there are certain activities for which the Technical Committee, as a whole, is responsible, some of these are briefly described as follows:—

(*a*) FOUNDRY EXHIBITION. The Technical Committee was the medium by which the Institute participated in the Foundry Exhibition held at Olympia in September last. By courtesy of the organisers, F. W. Bridges & Sons, Limited, a stand was placed at the Institute's disposal and the organising and staffing of the stand was undertaken by members of the Technical Committee.

The exhibit included castings in special irons; recommended methods of gating malleable cast iron and non-ferrous metals; specimens showing the behaviour of refractories under varying conditions; a display of sand-testing apparatus; numerous charts of technical interest and reports on foundry costing.

As a result of this exhibit, members of the Institute were enabled to see the part which the Technical Committee is taking in connection with the development of foundry technique, and the interest of a number of non-members was aroused, with the gratifying result that some twenty applications for membership of the Institute were received.

(*b*) REPRESENTATIVES ON OTHER NATIONAL COMMITTEES. The Technical Committee is the medium by which the Institute is represented on the appropriate Committees of the British Standards Institution, and also on appropriate Committees of other Technical Societies whose work is of interest to ourselves. The Institute directly participates through the Technical Committee, in the preparation of specifications.

(*c*) NOMENCLATURE. The Sub-Committees in their work have found it necessary to give a correct definition of certain foundry terms, and to attempt to standardise these terms. The Technical Committee is engaged in compiling a list of standard definitions and terms which will be of increasing value and which it hopes to publish in due course.

(*d*) INQUIRY BUREAU. This was established a few years ago and continues to give useful service to members who may require specific information upon some problem of foundry technique or guidance as to where information can be found. Inquiries are submitted to the appropriate Sub-Committee, and if necessary, other Sub-Committees are consulted; as far as possible the inquiry is treated confidentially.

(*e*) TOLERANCES ON DIMENSIONS OF CASTINGS. The Malleable Cast Iron Sub-Committee has recently tabulated the variations in dimensions of castings which may reasonably be expected under given conditions, and as a result is convinced of the desirability of specifying tolerances in specifications covering the ordering of castings. The work has been extended in collaboration with other Sub-Committees who cover castings in other metals than malleable cast iron and a comprehensive report on the subject will be presented at the Annual Conference at Glasgow.

Committee Reports

In addition to the report on tolerances mentioned above, the Non-Ferrous Sub-Committee will also present a Paper to the Conference in Glasgow dealing with "Some Recommendations of the Non-Ferrous Sub-Committee for Specifications for Two Leaded Gunmetals."

It is hoped that the written discussions on these reports will bring out additional information and suggestions which will increase their value to the industry.

The Costing Sub-Committee has followed its work on Melting Costs by preparing a tentative report on Moulding Costs. This has been submitted to a number of Branches of the Institute during the Winter Session and a fuller report will be prepared embodying the criticisms and suggestions made on the report by the various Branches.

From time to time the Sub-Committees have found it necessary to enlist the co-operation of various firms in the industry either by submitting a questionnaire or by conducting a certain amount of experimental work. The Technical Committee wish to tender its thanks to those firms who are co-operating with the Sands Sub-Committee in making practical tests of a number of sand mixtures.

The Convener takes this opportunity of expressing his thanks to the members of the Committee and particularly to the Sub-Committee Conveners, for the large amount of important work which they have performed during the year, and for the considerable amount of travelling which all members have undertaken at their own expense. The work which the Technical Committee does is intended to benefit the Institute and the industry as a whole, and it cannot be emphasised too strongly that all this work is done voluntarily and in a public-spirited manner.

J. W. GARDOM,
Convener, Technical Committee.

REPORTS OF SUB-COMMITTEES

Sub-Committee on Cast Iron

The proposed alterations and additions to the B.S.I. Specifications for Cast Iron have occupied the attention of this Sub-Committee throughout the year. The Sub-Committee has played a prominent part in assisting the British Standards Institution to frame the requirements for the new high-duty cast-iron specification; it is expected that this will shortly be available in draft form. They have also kept in close touch with the proposed modifications to the standard test bars, which work is proceeding satisfactorily.

The second series of typical microstructures is now completed and it is hoped that these will be published shortly. This series, which has been compiled in collaboration with the British Cast Iron Research Association as before, includes typical structures of various irons not shown in the first series, martensitic and austenitic cast irons, examples showing deep etching to reveal phosphide eutectic, and a separate section on malleable cast iron which the Malleable Sub-Committee has drawn up.

Continuing its work upon the soundness of castings the Sub-Committee has given attention to the subject of the gating and feeding of castings. This is a vast subject, and as a preliminary they are compiling a drawing showing various types and parts of runners and risers, with agreed nomenclature.

The list of physical data for cast iron, issued in 1932, is being reviewed in the light of information published since that date, with a view to re-issue.

In consequence of the reorganisation of Sub-Committee work, this Sub-Committee has lost the services of Messrs. L. W. Bolton, B. Hird, and F. K. Neath. Mr. E. B. Ellis has joined the Committee and Messrs. G. L. Harbach and A. A. Timmins have been co-opted. The six meetings of the Sub-Committee held during the year have been well attended.

P. A. RUSSELL,
Convener.

Sub-Committee on Costing

Since the last Annual Report, the Sub-Committee has gone into the question of costs in the moulding department. The result of the discussions on this subject was embodied in a Paper that was presented before a number of Branches during the Session 1935-36.

As a result of the discussions that followed the reading of that Paper, we have gone further into the subject and we are now coming to the end of our investigations with regard to moulding costs.

We are now going to investigate costs in the core department, and this will be followed by the other departments of the grey iron foundry.

A Paper covering the extent of our researches to date will be ready by about February, 1937. It is scheduled for discussion before the London Branch in March, and will be available to other Branches.

We hope that we may, perhaps, be in a position to complete our work on costs in the grey iron foundry in time to present an interim report at the Derby Conference in 1937.

V. DELPORT,
Convener.

Sub-Committee on Malleable Cast Iron

As previously reported this Committee has, during the last few years, been investigating the subject of specified tolerances on the dimensions of castings. The Steel Castings, Non-Ferrous, and Grey Cast Iron Sub-Committees have co-operated in this work, which is being published at the Glasgow Conference.

A number of photomicrographs of Malleable Cast Iron have been contributed for inclusion in Series No. 2 of Typical Micro-Structures, published by the Cast Iron Sub-Committee.

The investigation which has been in progress for some time, considering the possibility of utilising a standard test bar with specified different test requirements to represent various sections of metal, has progressed during the year but has not yet been completed.

The correlation of physical properties of malleable cast irons with micro-structure has occupied the attention of the Sub-Committee for a very long time, but during the last 12 months no work has been accomplished because of the urgency of other investigations.

It is expected that during the next year the Sub-Committee will put information before the British Standards Institution's Committee which is considering the revision of malleable cast iron specifications.

A. E. PEACE,
Convener.

Sub-Committee on Melting Furnaces

The principal work of this Sub-Committee has been concerned with the preparation of the Paper on melting furnaces which was mentioned in the previous Annual Report. It was intended that this Paper should be presented at the Glasgow Conference, but as it was not possible to include data on all types of furnaces envisaged, the Paper has been withheld for the present and will be published later.

Considerable progress has been made with the assembly of data on cupola and rotary melting furnaces for cast iron.

F. K. NEATH,
Convener.

Sub-Committee on Non-Ferrous Castings

The work of the Sub-Committee on Non-Ferrous Castings during 1935-36 has been largely concerned with collation and correlation of data for assembly into the Paper presented at this year's Glasgow Conference.

When this Paper is in print, it is proposed to ascertain the views of even a wider circle of users on the general suitability of the two lead gunmetals which have been proposed by the Sub-Committee in the Paper. A good deal of similar work has been done by the Sub-Committee during the year on the subject of lead phosphor bronzes which find extensive use in industry for bearing bronzes particularly where soft or semi-hard journals are concerned. It is

proposed during the coming year to take this matter further with the view to the submission of a similar Paper to that presented at this conference embodying the Sub-Committee's recommendations as to the most suitable alloys to employ, their physical properties, and suggestions for standardisation.

F. W. ROWE,
Convener.

Sub-Committee on Refractories

The Sub-Committee has considered the characteristics which are desirable in cupola firebricks and has drafted for presentation to the Technical Committee, a tentative specification. The tests suggested are based, with necessary modifications, on the Standard Specifications for Gasworks, issued by the Institution of Gas Engineers in July, 1934.

Preliminary consideration has been given to the testing of cupola ganister, and in due course it is hoped that it will be possible to draft a specification and indicate simple methods for testing and evaluating this material.

In furtherance of the work of this new Sub-Committee, the Convener has addressed the Birmingham, Sheffield, and Lancashire Branches, on the general subject of cupola refractories.

W. J. REES,
Convener.

Sub-Committee on Sands

In the last Annual Report, reference was made to the questionnaire on moulding sands, which had been circulated to a number of firms, and in which they were invited to make practical tests of a number of sand mixtures to enable the Sub-Committee to check the results on the sand testing apparatus they had recommended.

One hundred and four replies have been received. These have been tabulated by Dr. J. G. A. Skerl, and are now being studied by the members of the Sub-Committee. The conclusions arrived at will be published later.

Work is being continued on dry compression strength testing, the testing of dry sand and loam having been thoroughly discussed, and oil sands are now being studied. It is expected that definite data will be ready for publication next year.

Mr. N. D. Ridsdale has submitted a series of tests on permeability by the orifice method, using the method on A.F.A. types of apparatus and eliminating time, measuring pressures only. The Sub-Committee has decided to recommend this method for shop routine tests.

The Committee has dealt with a number of inquiries from other Sub-Committees on the subject of sands, and participated along with other Sub-Committees in organising the Technical Committee exhibit at Olympia last September.

Since its formation, the Sub-Committee has been known as the Sands and Refractories Sub-Committee; all matters dealing with Refractories will in future be undertaken by the Refractories Sub-Committee under the convenership of MR. W. J. REES, and this Committee will cover all matters connected with moulding sands.

B. HIRD,
Convener.

Sub-Committee on Steel Castings

During the year the Committee has been reorganised and enlarged; this has somewhat delayed the work, but a very full programme of investigation has now been undertaken. These investigations include:—

(*a*) A research into the effects of heat treatment, undertaken after receiving a report by one of the members.

(*b*) An investigation into the soundness of steel valve castings.

(*c*) A consideration of and research into all the possible factors affecting the occurrence of defects in steel castings, with especial reference to hot tears or pulls.

In beginning this work, considerable preliminary work by individual members was necessary, also it was thought desirable to arrange co-operation with other scientific bodies interested in the same subjects. These arrangements are now satisfactorily complete.

C. H. KAIN,
Convener.

Oliver Stubbs Gold Medal

In announcing the award of the Oliver Stubbs Medal, the PRESIDENT intimated that the Council this year had decided to award two medals, one to Mr. F. Hudson and the other to Mr. E. Longden. He remarked that the members were all familiar with the amount of valuable work Mr. Hudson had done recently on the subject of moulding sand, while in the case of

J. HEPWORTH, M.P., J.P.
(*Junior Vice-President of the Institute*).

MR. HEPWORTH served his apprenticeship with Thornton & Crebbin, Limited, engineers, of Bradford, and after this period he was appointed manager of the firm of E. B. Grandage, tool makers, holding that position for 12 years. Then, with his father, he founded the firm of Hepworth & Grandage, Limited, and was managing director of that firm until 1933. A Justice of the Peace, Mr. Hepworth was elected to Parliament in 1931 and re-elected in 1935 as a National Conservative. His present main industrial activity is that of managing director of the Bradford Piston & Piston Ring Company, Limited, Albion Works, Bradford. In the sphere of sport, Mr. Hepworth is vice-chairman of the Bradford Northern Union Rugby Football Club, whilst he has always interested himself in motor racing, and has won many trophies.

Mr. Longden they were also familiar with the work he had done on the subject of soundness, shrinkage and distortion in castings.

Meritorious Service Medal

MR. H. WINTERTON, the President-Elect, announced that it had been decided to award the Meritorious Service Medal this year to Mr. James Smith of Newcastle. He added that Mr. Smith was unfortunately unable to be present that night to receive the medal, but he expected to be able to be present on Thursday night on the occasion of the second Edward Williams Lecture, when the formal presentation would be made.

Awards of Diplomas

The SECRETARY announced that the council this year had agreed to the award of three Diplomas: the first to Mr. G. L. Harbach for a Paper on "Relationships in Cast Iron Test Results," the second to Mr. A. Phillips for a Paper on "Recent Foundry Developments," and the third to Mr. J. McGrandal for a Paper on "Some Notes on Using Metal Moulds for Cast Iron."

E. J. Fox Medal

In formally announcing the establishment of the E. J. Fox Medal, the PRESIDENT stated that just over a month ago Mr. E. J. Fox in a letter to himself had indicated that he would like to present a capital sum of £500 to create an award to be within the gift of the Institute and to be awarded for services and outstanding work in connection with metallurgy, particularly with reference to Foundry Metallurgy. That letter had been considered by the council, and, needless to say, the gift had been very gratefully accepted. Since that time a Sub-Committee of the council had met Mr. Fox and discussed with him in detail the proposed constitution of the new award. At the council meeting held that afternoon it had been decided that the medal be known as the E. J. Fox Medal, and a series of rules governing the award had been drafted and would be promulgated in due course. The rules provided for advice being given to the council of the Institute as to suitable nominations for the award by means of assessors, and two assessors had been appointed, who would act in consultation with the President of the Institute to advise the council regarding nominations suitable to receive the award. The two assessors who had agreed to act were Sir Harold Carpenter and Sir William Larke, both of whom were outstanding personalities in the metallurgical world, and incidentally at the same time were honorary members of the Institute. The President added that the object of Mr. Fox's action in making this gift was to create a sort of memorial to commemorate the work that had been done in this country in the development of the centrifugal casting process. Mr. Fox considered, and rightly so, that this country had taken a leading part in the development of the centrifugal casting process as a process in the realms of foundry metallurgy, and with the object of marking the work that had been done in this country in that direction he had presented this sum of £500 to the Institute.

Election of President

The PRESIDENT, in proposing Mr. H. Winterton (Scottish Branch) as his successor in the presidential chair, said that he did so with peculiar pleasure because during his year of office he had been closely associated with Mr. Winterton, and whilst he could claim to have been a friend of Mr. Winterton's before he was raised to the presidential chair, he was perfectly certain that his association with Mr. Winterton during his year of office had only served to increase that friendship. Mr. Winterton had been a member of the Institute for a very long time, in fact so long as to be able to possess a membership card dating back to the early days of the Institute when it was the British Foundrymen's Association, and when he believed the membership fee was about the same as a present-day driving licence. He was sure they would all agree that for consistent loyalty, energy and activity in the interests of the Institute there was no one who could beat Mr. Winterton's record.

MR. J. CAMERON (Past-President), in seconding, remarked that this was the second time the Scottish Branch had nominated an Englishman for this position. From many years friendship with Mr. Winterton, and from a knowledge of his business capacity, his generosity, his driving force and his enthusiasm, he was convinced that Mr. Winterton would prove himself an ideal President of the Institute.

MR. WINTERTON was unanimously elected. In acknowledging the honour conferred upon him, he recalled that in September, 1905, he was proposed as a member of the Institute. He assured them he would do his very best to adorn the position in which they had placed him, and he sincerely hoped that in a year's time when he came to demit office, he would have the pleasure of knowing that the membership was over the two thousand mark.

Vote of Thanks to Retiring President

MR. WINTERTON proposed a hearty vote of thanks to the retiring President, which Mr. Hurst suitably acknowledged. Mr. Hurst remarked that it had been a matter of great personal pride to him to have been President of this Institute, and it was a memory which he would always treasure. He concluded with the remark that it would have been utterly impossible for him to have done any work at all but for the able support of the Secretary, Mr. Makemson, who had proved a tower of strength.

Election of Vice-Presidents

MR. WINTERTON proposed the name of Mr. C. W. Bigg, of Derby, for election as Senior Vice-President. Mr. V. C. Faulkner (Past-President), in seconding, remarked that Mr. Bigg had already presided with considerable distinction over the East Midland branch, and his period of office as Junior Vice-President of the Institute had also been successful. Mr. Bigg had joined the Institute in 1915, and surely there was never a more lusty war baby. He considered that it was only fitting they should give Mr. Bigg, as his twenty-first birthday present, the position of Senior Vice-President.

MR. BIGG, who was unanimously elected, responded. He said that Mr. Faulkner had reminded him that he had been a member for 21 years, and he could truly say that those 21 years so far as he was concerned, had been an association productive of very much benefit and a tremendous amount of pleasure, and he was most anxious to do all he could to promote the best interests of this Institute.

On the motion of MR. J. CAMERON (Past-President), seconded by MR. WORCESTER (Past-President of the West Riding of Yorkshire Branch), Mr. Joseph Hepworth, J.P., M.P., was unanimously elected Junior Vice-President. MR. HEPWORTH suitably acknowledged the honour.

Election of Auditors

On the motion of MR. ROY STUBBS, J. & A. W. Sully & Company, Chartered Accountants, were unanimously re-elected auditors for the coming year.

Election of Members of Council

The SECRETARY announced the result of the ballot for the election of five members of Council. The following were elected:—Mr. A. Campion, Mr. J. W. Gardom, Mr. B. Hird, Mr. F. K. Neath and Mr. J. M. Primrose.

Election of Honorary Members

The PRESIDENT proposed the election as Honorary Members of the Institute of Prof. Albert Portevin, a distinguished French metallurgist holding the Chair of Professor at the Foundry School in Paris, and also Professor at the School of Arts and Manufactures; and Dr. Percy Longmuir, one of the founding members of the Institute, having joined in 1904 and having occupied the office of President in 1910-11. MR. WINTERTON seconded, and Prof. Portevin and Dr. Longmuir were unanimously elected Honorary Members.

The PRESIDENT, in closing the proceedings, mentioned that a few days ago one of their esteemed members of Council, Mr. McClelland, celebrated his golden wedding, and on behalf of the members of the Institute he conveyed to Mr. McClelland hearty congratulations.

The PRESIDENT extended a cordial welcome to Mr. Guy and Mr. Moore, two members of the Institute from South Africa. He mentioned that Mr. Guy was President of the Engineering Employers' Federation in South Africa.

Civic Reception

Following the Annual General Meeting the members and their ladies repaired to the City Chambers, where they were entertained at a Civic Reception by the Lord Provost and Magistrates of the City. In the Satinwood Salon from 8 to 8.30 p.m. the guests were received and individually greeted by the Lord Provost; Mr. J. E. Hurst, the retiring President, and Mr. Harry Winterton, the President-Elect. Thereafter the company proceeded to the Banqueting Hall, where an interesting little ceremony took place.

The LORD PROVOST (Mr. John Stewart) presided, and was accompanied on the platform by Bailies Cochrane and Jean Mann, Mr. J. E. Hurst, Mr. H. Winterton, Mr. John Craig (managing director of Colvilles, Limited) and Mr. Daniel Sharp (Convener, Conference Executive Committee).

The LORD PROVOST, in extending to the guests on behalf of the Corporation of Glasgow a very hearty welcome to the City, remarked that in the course of a year's work it was his duty and privilege to meet many people who were attending conferences, but in view of the fact that Glasgow was a great industrial city he could hardly conceive of a more appropriate conference that should be received by the City of Glasgow than that of the Institute of British Foundrymen. As they were all aware, Glasgow's prosperity depended very largely on the production of iron and steel, as well as shipbuilding and engineering, and he supposed there could really be no shipbuilding or engineering without the foundrymen.

Personally, he did not pretend to know very much about foundry work, and quite frankly, from what he knew of it, he was not particularly anxious to work in a foundry at all (laughter). One of the first houses occupied by him in his early married life was located in the south side of Glasgow next to a foundry known as the Hayfield Foundry, and in that foundry they cast some of the large, or what was considered in those days large castings for some of the ocean liners. There he had an opportunity of observing the kind of work that foundrymen were called upon to do, and without knowing anything about the technicalities of the trade at all, he could see that they were a very hard working body of men. They used to call them "the black squad" in Glasgow, because, of course, anybody who worked in a foundry was bound to get a certain amount of the grime attached to himself, but as long as it was clean grime there was nothing wrong with it. He remarked that Glasgow as a city was almost entirely industrial, but the environs of the city were very beautiful, and he advised them, if time permitted during their stay in the City, to take a trip down the Firth of Clyde, the scenic beauty of which took some beating.

MR. HURST, in conveying to the Corporation of Glasgow, through the Lord Provost, the thanks of the Institute for the hospitable manner in which they had been received, recalled that the last time the Conference was held in Glasgow was in the year 1925, eleven years ago, and in the official record of the proceedings on that occasion it was succinctly stated that at the Civic Reception, which took place on that occasion in the afternoon, the oratory was brief on account of the heat. (Laughter.) Mr. Hurst went on to say that Scotland was famous in our metallurgical history in so far as it related to foundry work, and that in itself was an attraction to them in coming to Glasgow and holding their Conference in this great city.

MR. WINTERTON, who followed, formally proposed a hearty vote of thanks to the Lord Provost and Magistrates of the City, to which the Lord Provost suitably responded.

An enjoyable programme of vocal and orchestral music followed, while dancing was indulged in by many of the guests till 11 p.m.

Opening of Conference

The first Session of the Conference opened on Wednesday morning, June 10, in the Rankine Hall of the Institution of Engineers and Shipbuilders in Scotland, Elmbank Crescent. The retiring President (MR. J. E. HURST) presided during the early part of the proceedings, and at the outset formally introduced the Lord Provost of Glasgow (Mr. John Stewart), Sir James Lithgow, Bart., M.C., D.L. (President of the Reception Committee), Col. Norman Kennedy, D.S.O. (President of the Chamber of Commerce), and Sir Arthur Huddleston, C.M.G., O.B.E., M.A. (Director of the Royal Technical College).

THE LORD PROVOST said his main business there that morning was again to extend to them a very hearty welcome to the City of Glasgow. He supposed the main purpose of the Institute and of this Conference was to discuss the matters intimately relating to the scientific and material conditions of their business. The foundry after all was the very basis on which shipbuilding and engineering rested. He supposed it would be impossible to produce a steam engine or a ship, or even some small domestic article such as a pot or pan, without the foundryman's skill. It was well known, for example, that in producing the "Queen Mary" the foundryman's business was intimately related to its construction, and that rather more than 1,000 tons of castings had to be cast before the ship could be built. They were all exceedingly glad that trade had improved materially. In Glasgow they had suffered very much indeed owing to unemployment, and, like some other districts that had more or less concentrated on the heavy industries, Glasgow had possibly had more than its share of unemployment, and he was more than delighted that the unemployment figures were going down very materially. Interpreting their feelings, he was sure they all hoped that for some years to come this country would become more prosperous, which would be of great benefit to everybody in the country. The Lord Provost concluded by expressing the hope that the visitors would all enjoy their stay in Glasgow.

SIR JAMES LITHGOW said that his duties that morning were both pleasant and light, being merely to welcome them to Glasgow on behalf of the Reception Committee, of which the Institute had so kindly asked him to take the Presidency. He expressed the hope that the arrangements that had been made for their comfort during their business session and for their entertainment during their time of recreation would be all they would like them to be. He trusted their proceedings would be useful and fruitful, and that when they left the City they would look back on their visit with feelings of satisfaction.

COL. NORMAN KENNEDY said he considered it a distinct privilege to have been asked to come there that morning to extend on behalf of the directors and members of the Glasgow Chamber of Commerce and Manufacture a very warm welcome to the delegates. He hoped that their deliberations would be successful and profitable. He had had the opportunity of looking through their report, and, if he might say so, he would like to congratulate them on that report, and to say that he was very greatly impressed with the thorough way in which their committees and sub-committees had done their work. If the rest of their work was done in as thorough a manner, he was perfectly certain their 1936 Conference would be a huge success.

When one looked round the world to-day it was rather a dismal picture one saw. In some countries we saw the people so held down by dictators that personal liberty was almost a thing of the past; other countries were so embroiled in political strife that things were at a standstill; while other countries again had such an industrial unheaval just now that trade and commerce were virtually brought to a standstill. When one looked to the other side of the picture we ought to be very grateful that we belong to the great British Commonwealth of Nations. (Hear, hear, and applause.) It was true we had our difficulties and troubles, but we met together in a friendly spirit and discussed them, and we generally managed to find a solution. It seemed to him that in these

difficult conditions in which we live to-day, the difficult world conditions, the intense competition, and very often unfair competition that trade had to suffer on account of trade barriers, the day of the individual for the present at any rate had gone. That was why he thought that technical conferences of this kind were invaluable. An individual could not kick against a trade barrier, but a conference could do something to mitigate that evil, and that was why he thought they would be able to do much good work through this conference. For the same reasons he thought that to-day the work of Chambers of Commerce was every day becoming more important. He asked them when they returned home to support their local Chamber of Commerce, if they were not doing so already.

With regard to shipbuilding, the industry was undoubtedly in a very much happier position than it had been for many years. Thanks to the mercantile and naval tonnage at present under construction, the industry was enjoying greater prosperity than it had experienced for over five years. There was, however, the unfortunate decrease in the orders received from abroad, which had dropped from pre-war figures in respect of tonnage to about one-tenth of the pre-war total. It was rather disquieting to read that no less than 500,000 tons of shipping was being built in Japan. He thought no one would refute him when he said that shipbuilding in this country, and on the Clyde especially, was never in a healthier or more efficient condition than it was to-day. Shipbuilders and marine engineers had used these years of depression to perfect their products, and to perfect their efficiency, with the result that the cargo boat built to-day could carry twice as much cargo in relation to fuel consumption as had its predecessor of ten years ago. The prospects were undoubtedly bright, and it was the sincere wish of the Glasgow Chamber of Commerce that their Conference would be a distinct success, and that it might result in greater prosperity, happiness and perhaps increased prices for their industry.

SIR ARTHUR HUDDLESTON, in extending a welcome to the delegates on behalf of the technical and scientific institutions of Glasgow, remarked that the Institute of British Foundrymen stood for progress in their industry. In these days progress was in every point associated with scientific progress, and the institutions for which he spoke were essentially concerned in scientific progress. It was all-important that there should be the closest connection between them, and therefore the institutions for which he spoke welcomed most warmly the fact that they were holding this conference in Glasgow, and he hoped they would enjoy their visit and that it would be profitable in every way.

Presentation of the Oliver Stubbs Medal

The PRESIDENT intimated that the next item on the agenda was the presentation of the Oliver Stubbs medal. As they all knew, this was the highest award it was possible for the Institute to give, and it was awarded for services of outstanding merit in foundry research. This year the Committee had decided to award two medals, one to Mr. F. Hudson and the other to Mr. E. Longden. He concluded by inviting the Lord Provost to make the presentation of the medals.

The LORD PROVOST thereupon formally presented the medals to Mr. Hudson and Mr. Longden.

MR. HUDSON, in responding, said he was deeply appreciative of the honour they had conferred upon him in presenting him with the Oliver Stubbs medal. He could only say thank you, but in expressing his thanks he desired to couple them with the name of Glenfield & Kennedy, Limited, because if they had not given him facilities for doing this work it was possible he would not have won the medal.

MR. LONGDEN said he appreciated the honour that they had conferred on him. He thought he could say that the Lancashire Branch would also feel honoured by this award. He also wished to thank the FOUNDRY TRADE JOURNAL, which provided a further means of expressing one's thoughts.

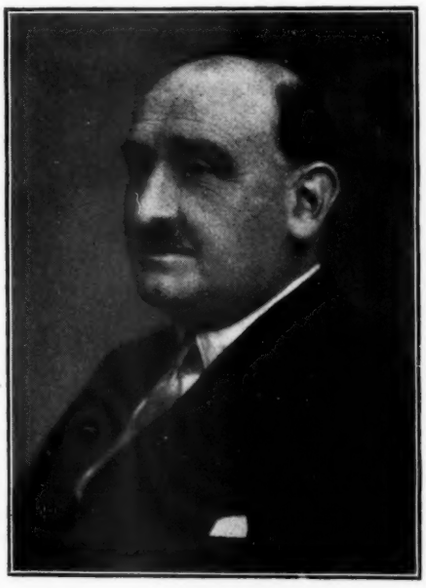
Sir Archibald McInnes Shaw Medal

The LORD PROVOST then presented the Sir Archibald McInnes Shaw Prizes to Mr. Alexander Wallace, an apprentice patternmaker, and Mr. Peter Miller, an employee of Mavor & Coulson, Limited, Glasgow.

The PRESIDENT announced that this year it had been decided to award the Meritorious Service Medal to Mr. James Smith, of Newcastle.

The E. J. Fox Gold Medal

The PRESIDENT also announced the establishment of another medal to be known as the E. J. Fox Gold Medal. He went on to remark that



E. J. Fox

(Managing Director of Stanton Ironworks Company, Limited, who has given the sum of £500 to provide a gold medal annually for foundry metallurgical research. The first award is expected to be made next year at Derby).

one of the most outstanding developments in foundry metallurgy during the post-war years was that of the introduction and perfection of the centrifugal casting process. This had become a fully developed process which came to be regarded as ranking equally in importance with others of the great metallurgical developments. To commemorate this event, Mr. E. J. Fox, managing director of the Stanton Ironworks Company, Limited, had presented to the Institute of British Foundrymen the sum of £500 to be invested as a Trust, the revenue therefrom to be expended annually in the provision of a suitable medal to be awarded to any individual who had contributed in some outstanding way to the progress of the foundry industry with particular reference to foundry metallurgy. The active association of the President of the Institute with the development of the centrifugal casting process, was regarded by Mr. Fox as creating a fitting opportunity to make this gift to the Institute. The council of the Institute had conveyed to Mr. Fox their willingness to administer this gift, and expressed their appreciation of the honour done to them and also the implied honour to their President in entrusting the Institute with this gift. In view of the fact that the centrifugal casting process was developed largely at Stanton by Mr. E. J. Fox and brought to commercial perfection in Great Britain, the council of the Institute had decided that the Award should be known as The E. J. Fox Gold Medal, thus commemorating for all time the important part played by Mr. E. J. Fox in retaining for Great Britain the honour associated with the development of this important metallurgical process.

MR. C. E. WILLIAMS expressed on behalf of the members of the Institute their very great appreciation of Mr. Fox's generosity.

The PRESIDENT proposed a vote of thanks to the Lord Provost of Glasgow, Sir James Lithgow, Sir Arthur Huddleston and Col. Norman Kennedy. MR. WINTERTON seconded, and the Lord Provost suitably responded.

Induction of New President

MR. HURST then formally invested Mr. Winterton with the Presidential Badge and Miniature and installed him as the Institute's thirty-third President. He remarked that the members could rest assured that Mr. Winterton would make an excellent President, and he was satisfied they would all be delighted to serve loyally under him.

Presentation of Badges

MR. WINTERTON having formally occupied the chair amid prolonged applause, his first duty was to present the Past-President's badge to Mr. Hurst. He said he felt sure they all agreed that the Institute had never had a better President than Mr. Hurst.

MR. HURST, in replying, said it had been a matter of great pride to him to have been President of this Institute. He had enjoyed his year of office very much indeed, and he wished to thank every single one of them, officers and members alike, for the loyal support and enthusiasm they had shown during his term of office.

MRS. HURST then presented to Mrs. Winterton the collarette and badge which is worn by the President's wife.

MRS. WINTERTON expressed her pleasure in receiving the collarette and her appreciation of the honour it carried with it.

The PRESIDENT then invested Mr. C. W. Bigg with the collarette of the Senior Vice-President, which MR. BIGG acknowledged.

The SECRETARY (Mr. T. Makemson) remarked that they had now had the presentation of various badges, but this year for the first time there would be an additional badge. There had now been provided a badge for the use of the Junior Vice-President, and he was afraid he was going to commence the Presidential year of the new President by disobeying the instruction. He was going to tell them by whose generosity that badge had been provided. It had been given to the Institute by the new President.

The PRESIDENT invested Mr. Joseph Hepworth, J.P., M.P., with his badge of office as Junior Vice-President.

In acknowledging the honour, MR. HEPWORTH remarked that, although he was practically only an apprentice in the work of the Institute, he was extremely proud to be the first recipient of this magnificent badge. The associations he had made since he joined the Institute had been to his advantage, and he trusted that the friendships he had made during the short time he had been associated with the organisation would long continue.

Greetings from Overseas

The GENERAL SECRETARY announced the receipt of the following messages:—

"Greetings and sincere best wishes from the American Foundrymen's Association upon the Thirty-third Annual Conference of the Institute of British Foundrymen.—Steinebach."

"Best wishes for the success of the Conference of our English colleagues.—Verein Deutscher Giessereifachleute, Berlin."

"The French Foundry Technical Association sends cordial salutations to their British colleagues, and best wishes for the success of the Congress.—Werts, President."

"Best wishes for the Conference in Glasgow of the Institute of British Foundrymen.—Prof. E. Piwowarsky and Prof. H. Nipper, Aachen."

From a Past-President: "I am very sorry that my health will not allow me to join the Conference at Glasgow. I well remember a very successful Conference there in the early days of the Foundrymen's Association. I shall be glad if you will kindly remember me to old friends.—Sydney A. Gimson."

The General Secretary intimated that greetings had also been received from two Past-Presidents, Mr. A. Harley, who wished to be remembered to all friends, and from Mr. Wesley Lambert, C.B.E., while an apology for absence had been received from the author of one of their Papers, Prof. Albert Portevin.

Welcome to Foreign Delegates

The PRESIDENT, on behalf of the Institute, extended a hearty welcome to those visitors who had come from overseas, including several from Germany, America and South Africa.

MR. WINTERTON then delivered his Presidential address.

PRESIDENTIAL ADDRESS

Mr. Hurst and Gentlemen,—

An interval of eleven years has elapsed since my old friend, Mr. John Cameron, had the pleasure of extending to the members of this association a hearty welcome to Scotland. Though my welcome to you may perhaps not be so characteristically Scottish, yet I can assure you that it is none the less hearty, and I esteem very sincerely the honour you have done me in placing me at the head of the Institute as its President and thus affording me the opportunity of greeting you on this visit to the land of my adoption. We are growing accustomed nowadays to hear of the trend southward of trade and population, and although in some measure there may be a certain amount of ground for that assumption, it must not be forgotten that there is an almost continuous interchange with the North of both trade and people. This is all to the good, I think, and tends to bind the two countries closer and closer together, not only from the national standpoint, but also from the point of view of trade.

Since the inception of the Institute, which, as you are all aware, was founded in 1904 as the British Foundrymen's Association, many changes have taken place, and much good work has been done on the lines laid down by the originators, whose avowed intention was to form an association having for its object the advancement from both practical and technical outlooks of the foundry industry, and a general co-operation amongst all branches of the trade for education, enlightenment and information on the widest possible basis.

How wide that basis has been and how generously the ideas of the founders have been interpreted my presence in the chair to-day bears ample testimony, and I am quite certain that all the sister trades which are indissolubly linked with the actual process of founding fully appreciate the implied honour which the parent has bestowed upon its offspring.

There are, however, still vast realms open for further enterprise in the direction of development, and year by year, as our knowledge increases, it seems that we are only at the beginning of our task, which becomes more onerous and responsible as our Institute advances in age.

In looking into various references by my predecessors in office to the work which lay before the Institute, I note that at the last conference in Scotland the President at that time remarked that there was a vast field for improvement in method, in organisation, and in research. Last year Mr. Hurst said that remarkable as had been the increase in knowledge during the past quarter of a century, it must not be supposed that all had been discovered or that finality had been reached. In many directions we were only on the gateway of knowledge, and through each doorway which had now been opened, the earnest student saw long corridors ahead. Truly prophetic words these, and I think that since these remarks were made, not only our own Institute, but many other allied associations, have been marching steadily onwards to the acquirement of that knowledge which will eventually make for success in many directions, and the opening out of still more avenues of research which must lead to the complete knowledge and thorough mastery of the industry both from the technical and practical point of view.

Educational Work

It must be very gratifying to the older and more experienced members of the Institute to realise that definite efforts are being made for the instruction of the younger members of the industry, and the steps taken in this direction by the establishment of special classes with distinctive courses at Glasgow, Birmingham, and Sheffield, should tend to prove that the efforts of the Institute and its younger yet still more learned offspring, the British Cast Iron Research Association, will have an appreciable effect upon the industry in the years to come. It is also pleasing to note that incentives to the encouragement of further technical and theoretical study and endeavour are not lacking so far as the Institute itself is concerned. The Oliver Stubbs medal, the Buchanan medal, the Surtees Memorial prizes, the Meritorious Service medal, all serve to foster interest in the work of the Institute and last year the establishment of the Edward Williams Lecture, delivered as it was by one of the pre-eminent industrial leaders of the day, marked an epoch which cannot fail to leave its mark upon the history of the Institute. This year we are to have the privilege of listening to Professor Mellanby, who will deliver the second lecture of the series.

Most of the members will have heard by this time, too, that, thanks to the generosity of Mr. E. J. Fox, managing director of Stanton Ironworks Company, a special gold medal is to be presented each year to the person adjudged to have been the inventor or introducer of some outstanding advance in foundry practice or to the person who shall be credited with such work or aid to the foundry trade as to contribute in the most marked degree to the advancement of the science generally. With these inducements, if indeed such were needed, it is easy to visualise rapid strides in the art and science of metal founding generally far in advance of those of former years, thorough and all embracing though these seem to have been.

While we are discussing the progress of the foundry trade in these times, it is very interesting to look back to the days when matters were not so advanced, when cast iron was in its infancy, and the methods of production crude and unreliable. The ordinary man in the street of popular renown is accustomed to regard Tubal Cain as the earliest artificer in iron and brass, and let it go at that. The manner of instruction by this earliest recorded leader of technical training and the method of handing down the instruction from generation to generation is lightly passed over, and information regarding the development of the industry is sparse and for the most part unauthentic. That some magnificent work in iron, brass and copper was done centuries ago cannot be disputed, and it would seem from relics which have been discovered from time to time, that the iron age followed that of copper and bronze, though undoubtedly the manufacture of the two latter demanded much greater metallurgical skill and knowledge than did the first named.

Early Scottish Ironfounding

So far as the English development of the ironfounding industry is concerned there seems to be plenty of information available, but such is not the case with regard to the Scottish trade, the records of which up to a point are vague and uninformative. It would seem that here is a promising opening for a man of letters and leisure. In the Middle ages it would appear that the Scots were satisfied, in order to obtain their supplies of iron, whether in the form of spears or plough-shares, to depend upon raids upon their more industrial and industrious neighbours in the North of England, and this desire for acquisition may possibly account for many of the forays which history records as having been made into the land beyond the Tweed and Solway.

It was not till the eighteenth century was well advanced that it became known that ironstone was abundant in Scotland. Up to that time the raw material had been imported from the Continent and from England and smelted with the aid of charcoal, the supply of which was becoming scarce. There was, however, no combination of interests, such as we know to-day, to lead to the working of the ironstone. As far west as Loch Fyne, where it was possible to import ore by water from the Furness district of England, iron was produced on a small scale, and, if I mistake not, the location of this industry of ancient days is marked by the appellation of Furnace given to a small village south of Inverary, but certainly exhibiting to-day no signs whatever of having once been a centre of iron smelting. Other small centres are mentioned as having contributed to the meagre output of those times, and it is certain that iron ore was to be had in Aberdeenshire, though there is no record of its having been exploited. But as recently as 1875, so Cadell records in his "Story of the Forth" there was to be seen at Taynuilt, near Oban, the largest and most important of the old Highland ironworks. This was established in 1753, and took the place of a furnace started by an Irish company at Glen Kinglass which is said to have been commenced in 1730, and relics of which can still be seen lying promiscuously in the neighbourhood.

About the year 1760 a great revolution took place in connection with the iron trade in Scotland, and from that date records are more authentic. Dr. Roebuck, the son of a Sheffield cutlery manufacturer, who had been engaged in the manufacture of sulphuric acid at Preston Pans, conceived the idea, together with Mr. Samuel Garbett, of Birmingham, and Mr. William Cadell, of Haddingtonshire, of establishing works for the manufacture of iron in Scotland. After much cogitation and what at that time must have been considered an enormous amount of travel, it was decided that a site in close proximity to plentiful supplies of ironstone, coal, limestone and water would prove the most successful, and it was under these conditions that the works at Carron, near Falkirk, which have now attained to such huge dimensions and world-wide renown, were launched.

One can conceive with what trepidation these hardy pioneers of the cast iron trade of Scotland entered upon their task. Of local skilled labour there was none; charcoal was the only means of providing the necessary heat, and it was realised that soon the forests would be depleted; coal certainly was in use, but no forced blast was available; transport was slow and unreliable, and in the light of later investigations it would seem that the small company of enthusiasts commenced on an impossible task. By degrees, however—and progress must have been slow—workers more or less skilled were

imported from the south, and then in 1762 Dr. Roebuck discovered the utility of coke as a fuel.

Perhaps the most drastic reformation was the introduction at Carron by John Smeaton, a Leeds man, and the builder of an Eddystone lighthouse, of an apparatus for the production of the powerful blast required for the smelting of iron ore. From this point it may be said that many of the troubles of the pioneers were over. Local labour was beginning to become more enlightened, and in this connection it is somewhat amusing and very instructive to note that while it was found absolutely necessary, if progress were to be made at all, to employ Englishmen, great care was taken to import as few as possible so as to ensure that a larger proportion of Scots helpers should be engaged and thus hasten the time when the whole of the work could be carried out by Scots.

I might carry you step by step along the road of progress in the iron trade of Scotland to the present time, but space forbids. I must, however, not omit to mention two other developments which had a marked effect upon the industry. These were the introduction of black band ironstone by Mushet, who was a bookkeeper in the Clyde Iron Works, and the adoption by Neilson of the hot blast. The use of the steam engine, introduced by James Watt, also helped considerably, but it is curious to note that it was at first used not to drive the engine developing the blast, but to pump the water back from below the water wheel into the reservoir. The black band ironstone was known for some years before it was recognised as a useful article of commerce, and it was not until 1825 that the first experiments proved its value. Still the foundry trade in Scotland did not make great strides till long after Queen Victoria came to the throne. Certainly the output of iron increased considerably and small plants were being erected in various parts of the country.

Then came the reaction after the Crimean war, and from that period development in all directions was rapid and progressive. The various public authorities became alive to the necessity of reasonable housing for the people, sanitation took a prominent place in the public eye, and education generally improved in all directions. The Clyde valley, helped by its waterway, which was being developed into a harbour for the largest known ships of that period, became transformed into a vast hive of industry, in which the iron trade took pre-eminence. Blast furnaces and heavy foundries sprang up, and were kept busy not only by the requirements of the shipbuilders, but also by the demands of the various authorities whose schemes of drainage and water supply were developing year by year. At one time four large foundries were principally engaged in the production of water pipes from 1 ft. to 2 ft. in diameter, cast by the vertical system in huge circular pits, and when the local demand subsided large quantities were exported to Canada and other places abroad. But new methods of manufacture succeeded the old, the English competition became keener, our cousins abroad laid down their own foundries, and the export trade from Scotland gradually weakened till about the year 1926 the last of the old pipe foundries closed down, and the site, which once carried huge workshops and stately offices, is now bare and silent, every brick and stone having been removed.

A Flourishing Industry

But the engineering and light castings foundries have continued to flourish and Falkirk and district still holds its own among the manufacturers of light castings and sanitary ware, though other towns such as Kirkintilloch, Barrhead and Glasgow itself turn out an enormous quantity of builders' ware. Edinburgh too now has its foundries, all of which may be classed as successful in their particular line, and various other centres throughout the Lowlands vie with the Clyde valley in its production of iron, for from time to time ore has been discovered in various new fields. Throughout the northern part of Scotland the development of machinery and plant of various descriptions has demanded the establishment of foundries and in most of the important cities the industry is progressing strongly on the most modern lines. Perhaps one of the most noticeable features of recent years has been the readiness of older firms to adopt mechanised principles, and many of the foundries established last century and even those who ranked amongst the very earliest have not hesitated to take that step in their desire to keep abreast of the times.

One important feature which has presented itself to me in my wanderings has been the ubiquity of the Scot, and particularly the Scottish moulder. Go where one will, into almost any foundry in any part of the world, one is almost sure to hear the well-known Doric accent, and I know of towns in England and Canada and Australia, where the Scottish accent is as pronounced as in the Gallowgate and that by men and women who have never visited the land of their forbears. What would be the feelings of Dr. Roebuck, who first brought English moulders to Scotland, if he could revisit the scenes of his early labours and find events so topsy-turvy is a matter of surmise?

Changed, too, are the methods generally adopted by the leading foundries throughout the land—and by this I mean Great Britain—from the days when Samuel Smiles' attempt to obtain permission to visit the Carron works was met with the somewhat ungracious reply, "Na, na, it canna be allooed. We canna be fashed wi strangers here." In these days, it seems, the more important the undertaking, the less likely is it to endeavour to surround itself with unreasoning insularity, and the fact that during this conference so many well-known firms have extended their hospitality to our members, proves that the onward march of time has begun to break down the old prejudices and barriers, and firms, irrespective of personal gain, are centring their attention on the higher attributes of trade and endeavouring hand in hand, as far as is reasonably compatible with commonsense, to reach the highest summit of excellence that it is possible to attain.

May I conclude my remarks upon a close personal appeal addressed to the heads of all foundries and allied trades in the British Isles. This Institute was established in 1904 and became a Royal Chartered Society sixteen years later. Many hundreds of foundrymen have passed through its membership books, and to-day there are 1,892 members, an increase over last year of 112. But this is not enough. The work of the Institute is valuable not only to the members, but to employers generally, to say nothing of the general public, who cannot fail to benefit in the long run by the research and practical labours of the Institute. The work is of an international character, as you are probably aware, and I therefore confidently recommend every member to endeavour during the coming years to induce friends to join our ranks. A goodly number of members visited the International Exhibition at Brussels last September and were made welcome, along with representatives of nearly a score of other countries, by the Belgian Association, whose President was honoured by the King of the Belgians by the presentation of the Albert medal in recognition of the services of the Association to the country. We have a representative list of subscribing firms but we could do with many more. Admitting the value of the work done, and the appreciation of that work on many occasions expressed by other associations both at home and abroad, let me impress upon you all the necessity for increased support financially, and most of all for a largely increased membership of all grades.

Gentlemen, again I thank you for the honour you have conferred upon me. I am aware of the fact that I follow many experienced and energetic Presidents, none more energetic perhaps than my immediate predecessor, and certainly none more cheerfully popular. But I will do my best to merit your trust and to carry out my duties to the best of my ability, and I confidently appeal to you all to accord me during my year of office that cordial support which has ever marked the labours of those who have preceded me in the presidential chair.

Vote of Thanks to the President

MR. HURST, in proposing a vote of thanks to the President for his address, made special reference to Mr. Winterton's admirable historical study of the origin of ironfounding in Scotland. He mentioned as a point of interest that perhaps the earliest attempt centrifugally to cast pipes was made in Scotland by Andrew Shanks, an ancestor of the present firm of Shanks & Company, Limited, which was still in existence. Somewhere about the year 1870 Andrew Shanks made and actually cast by the centrifugal process spigot and socket pipes, and that was probably the first attempt made to apply the centrifugal process to the casting of iron pipes. Mr. Hurst went on to say that it had struck him that the study of the history of the development of ironfounding, as distinct from the history of ironmaking, was a most fascinating one, and he had often wondered why this Institute had not taken on itself to organise some sort of collective attempt to study the history of ironfounding in their various districts.

A vote of thanks was accorded with acclamation and the PRESIDENT briefly replied.

Annual Banquet and Dance

The annual banquet, followed by entertainment and dancing, was held in the Grosvenor Restaurant, Gordon Street, Glasgow, on Wednesday evening, June 10, and afforded an opportunity to entertain some of the many friends who had helped so much to make the conference a success.

The President (Mr. H. Winterton) presided over a distinguished gathering, which included Sir James Lithgow, Bt., M.C., D.L. (President of the Reception Committee), Sir Arthur Huddleston, C.M.G., O.B.E., M.A. (Director of the Royal Technical College, Glasgow), Col. Norman Kennedy, D.S.O. (President of the Glasgow Chamber of Commerce), Mr. John Craig, C.B.E., D.L., J.P. (Chairman of Colvilles, Limited), Mr. A. McKinstry, M.Sc., M.I.M.E. (managing director, Babcock & Wilcox, Limited), Prof. Percy Hillhouse, M.I.N.A. (President of the Institution of Engineers and Shipbuilders in Scotland), Prof. Mellanby, D.Sc., M.I.Mech.E. (Royal Technical College), Mr. R. M. Allardyce, M.A. (Director of Education, Glasgow), Lieut.-Col. Macfarlane, D.S.O., Bailie Hector McNeill (Deputy-Chairman of Glasgow Corporation), Mr. J. E. Hurst (Immediate Past-President), Mr. C. W. Bigg (Senior Vice-President), Mr. Joseph Hepworth, J.P., M.P. (Junior Vice-President), Mr. Daniel Sharpe (President of the Scottish Branch), Mr. A. McCance, D.Sc. (President of the West of Scotland Iron and Steel Institute), Mr. J. B. Lang (John Lang & Sons, Limited, Johnstone), and Mr. P. H. Wilson (Stanton Ironworks Company, Limited).

The Toasts

The usual loyal toasts having been proposed by the President and duly honoured,

MR. JOSEPH HEPWORTH (Junior Vice-President) proposed "The City and Corporation of Glasgow." He said that their city and their country had reared men who had excelled in science, in literature, and even in politics, but last, though by no means least, was that great feat, the building of the "Queen Mary," an achievement of which any city or any country had every reason

to be proud. It was comforting, however, to know that they had to get a Yorkshire man to control and captain that magnificent ship. Of course, there was an affinity between Yorkshire men and Scotsmen; they were both noted for their unbounded generosity.

He supposed that the city of Glasgow, like every other city, had been passing through very critical times in recent years, and at this juncture he would like to strike a note of optimism and say quite frankly that, if we could only settle the international difficulties that we had been faced with in recent years, he ventured to suggest that not only their city, but all the cities in this great Empire of ours, would come in for a new era of prosperity, and he sincerely hoped that that day would not be long delayed. He felt sure that their city would continue to uphold the noble traditions of the past, and that when prosperity did come they would study the social conditions of the work and try to bring about more social amenities for the people in general.

Glasgow's Industrial Development

BAILIE HECTOR MCNEILL (Deputy-Chairman of Glasgow Corporation), in responding to the toast, conveyed the good wishes of the Lord Provost, world at large that, so far as shipbuilding and the allied trades were concerned, they still were top dog in the world, and they as a Corporation had their responsibilities in facing the problem of providing the industrialists of their city and country with a healthy, virile, competent race of men and women to carry on the work.

Speaking as a member of the Corporation, faced with a great housing problem, he hoped that in their efforts to give better housing conditions to the people of the city and thereby produce an A-1 race, they would be forgiven if there was a small increase in the rates of the city, because he was convinced that that would be repaid a hundredfold in a better physical type than they had had for a considerable number of years in the West of Scotland. Even the efforts that the Health Department of the Corporation had been able to put forward during the past 40 years had increased considerably the expectation of life of the citizens, and if one cared to look up the figures of the city one would see that the money that the Health Department were now spending, which was over a million pounds per annum, was all to the benefit of mankind. Bailie McNeill concluded with the remark that, having spent some time in Yorkshire, he could agree with everything Mr. Hepworth had said.

as The Scottish National Development Council and The Scottish Economic Committee showed a spirit of co-operation which was certain to redound to the welfare of the country. That development could not be real unless it was justified by the existence somewhere of a market for its products. World conditions to-day were such as to convince us of the increasing importance of our home market, and when one visited such a hive of industry as Clydeside with its teeming population one could not fail to appreciate the tremendous potentialities as a market of such a community, and he suggested that Scotland's problem, and indeed the problem of us all, lay in visualising the progress and conditions necessary to materialise the potentialities of such communities as markets, and ever-increasing markets, for the goods which our ever-increasing industries would produce.

MR. ARCHIBALD MCKINSTRY (managing director, Babcock & Wilcox, Limited), in replying to the toast, remarked that his life had been spent in engineering, and he had been struck by the important part that founding had played in that great industry. He thought that one of the chief exports of Scotland was Scotsmen. It had been his privilege to wander much about

THE ANNUAL BANQUET OF THE INSTITUTE AT THE GROSVENOR RESTAURANT, GLASGOW.

whom he had just left in the City Chambers welcoming the Automobile Engineers, who were also holding their annual conference within the city at this time. Coming straight from the Automobile Engineers' reception in the City Chambers, he did not know whether he should describe himself as a connecting link or a connecting rod, but if what he heard was true about the possibilities of increasing motor-car production in Glasgow, he could envisage the foundrymen being very busy producing those cylinders and pistons they were all talking about at this moment along at the City Chambers, and if that happened Glasgow would, he hoped and trusted, move out of its present depressed state so far as trade was concerned. Although there was to some extent a small boom in trade in Glasgow at the moment, they had still over 100,000 unemployed in the city, and they were facing that with courage.

He was convinced, speaking as one who had served his time in the Clydeside engineering shops, and speaking from what he had learned during his apprenticeship and the number of years he had worked as a journeyman, that they still had the leaders of industry and they still had the workmen who were able to show to the

The Foundry Industry of Scotland

MR. C. W. BIGG (Senior Vice-President), in proposing the toast of "Scottish Trade and Commerce," said that the foundry itself could be reckoned among the most important of Scottish trades. Among Scotland's oldest industries was that in which they were all proud to be engaged. Before Scotland achieved fame in shipbuilding, she had won some renown in the science and art of founding. A satisfactory source of castings supply was pre-eminently necessary to shipbuilding and engineering, and unless the foundry industry of Scotland had proved equal to every demand made upon it, the fame of Scotland in shipbuilding, engineering and many other industries would not be what it was at the present day. Southerners were apt to judge Scotland mainly by exports. It was a fact that one of the main exports of Scotland was men. The development of Scotland's trade and commerce had been such as to command for her a prominent place in the export markets of the world. Unfortunately, these markets were not open to her to the same extent as formerly, and it had been found that this had a marked effect on the home position. The formation of such bodies

the world, and he had met Scotsmen in every country he had visited, occupying, as many of them seemed to do, the most important positions in the various countries. The people of the British Isles could not support themselves on internal trade; we must make ourselves efficient for catering for the markets of the world, however difficult they might be at the moment. In the case of his own concern, they were paying in Scotland almost one million pounds' worth of wages per annum, and that was produced by a business which was made up of something like 65 per cent. of export trade. It was quite impossible to give employment to the people who needed employment in Scotland unless particular attention was paid to the requirements of the export trade. At the present moment there was enormous difficulty in dealing with that trade.

After detailing some of the difficulties experienced at the moment by British firms in securing orders from abroad, Mr. McKinstry said that although there was a comparative boom at the moment he did not think he ought to sit down without striking a note of warning. The present boom could only be continued if

particular emphasis was placed on the desirability of being able to enter other markets than our home market. Do not let us be unduly optimistic, but on the other hand do not let us be unduly cast down by the difficulties. He was perfectly satisfied that the courage, the ability, the resource and the ingenuity of Scotland and Scotsmen could hold its own against any competition, and that the wave of prosperity which was starting now would not die down in the very near future.

Foreign Policy and Its Bearing on Industry

The next toast, which was proposed by SIR JAMES LITHGOW (President of the Reception Committee), was "The Institute of British Foundrymen." Sir James said that Mr. Hepworth had referred to the difficulties in foreign countries. He (the speaker) was reminded that for a number of years now he had attended a conference at Geneva in the month of June as representing the British employers. This year for various reasons he was not attending that conference. Personally he was not one of those who scoffed at the League of Nations. He appreciated that our foreign policy had a definite bearing on the prosperity of the industries in which they were all engaged. He had spent very much time and very much thought in endeavouring to restrain the labour side of the organisation from that enthusiasm which, unfortunately, had brought the political side into the tragic disrepute that it now found itself in, where its authority had been very much lost. Neither did he condemn the efforts which had been made by successive British Governments to give a lead to the world in the matter of disarmament. After all, if Britain wished to continue to claim the leadership of the world in moral as well as material things, it surely was fit that our Government should make an effort to bring these peaceful methods about. Clearly, however, these efforts had failed. We had reached the end of the chapter so far as efforts of that sort were concerned, and we must regretfully look around for some other method by which we could continue that leadership.

Personally, he did not think we had anything to be ashamed of. We had run very great risks, and we had suffered in our industries very severely, but surely we were still strong enough to recognise that it was no use leading along lines where others would not follow. There seemed to be a feeling amongst certain harebrained individuals in our own country, and also amongst an ill-instructed section of the foreign Press, who after all did not look at matters in the same way as we did in this country, that we were following this policy of disarmament because we were afraid to do anything else, and he had been frequently struck on his visits to Geneva with the prevalence of the idea that after all the League of Nations was of some particular benefit to the British Empire. It was an entire mistake to imagine that we were in any way dependent upon it. We had in our Empire a league that was far more valuable than any heterogeneous league such as the League of Nations. (Applause.)

We had now come to the end of the chapter. The historians would put on record the part we had actually played, but while we had nothing to apologise for, we had nothing to be particularly dismayed about. He disagreed with the view that armaments necessarily lead to war. Armaments in the hands of peace-lovers had no need to lead in that direction. If we were to continue to give a lead in peace to the world, that lead had got to be in the nature of a police force. A police force had to be properly armed to obtain respect and to keep the peace, and that surely was the rôle we had been seeking to follow all these years, and he thought it was a rôle that we could with courage and satisfaction continue. He reminded them that their trade was very much wrapped up in what we might describe as the political attitude of Great Britain. Col. Kennedy that morning had referred to the fact that we had got rid of the great handicap of free trade, and it was quite obvious that free trade in theory was an excellent thing, but free trade when only practised by one country in the world was a complete handicap to that country. It took the statesmen a long time to make up their minds on that, but the result had been wholly satisfactory as far as the trade with which they were concerned went, and instead of being out of step with the rest of the world we were now in step, and we were now able to play our part in world trade so far as our internal conditions allowed us to do so.

Referring particularly to the foundry industry in its relation to the manufacture of arms, Sir James remarked that their business could be developed only when every phase was developed, and there was no more technical section than that connected with these works. He believed that they were entering upon a period when they would have an opportunity in every section to develop, and not only give employment but work up a reserve of capital strength, which was necessary if any industry was going to take advantage of the work of an Institute of this kind. It was no use carrying out technical research and making discoveries if the money and the men were not available to give effect to these discoveries when they were made, and therefore it seemed to him that this was a most appropriate time for their Institute to come to Glasgow and consider the problem, conscious, as he believed they were, of the fact that they were entering upon some real reward and return for all the brain and research work in which the members of this Institute were engaged. It was in that sense at least that he asked them to be upstanding and to drink the toast of "The Institute of British Foundrymen."

THE PRESIDENT'S REPLY

The PRESIDENT, in acknowledging the toast, alluded to the work that the Institute had done since its institution in 1904, and called attention to the cosmopolitan character of the meeting that night. During the last thirty odd years since the Institute was established he thought he might claim that they had made very considerable progress. The old rule of thumb had been practically eradicated, and to-day they found that the foundry problems which obsessed them from day to day in every foundry in the country were being tackled from a different point of view altogether from that of their forebears. He was satisfied that in his own particular branch of the trade thirty years ago the establishment of a laboratory would have been laughed out of court. To-day, on the other hand, they relied on what the men in their laboratories said, and they knew perfectly well that if they acted counter to the reports of these men they were asking for trouble. He was quite sure that his friends who were directly interested in foundry work were of the same opinion. At their meeting that forenoon at Elmbank Crescent they had a battle royal between the practical side and the theoretical side. Sitting in the chair, it was very difficult for him to say which side won, but he was sure his practical friends would forgive him if he said that he was inclined to side with the theoretical men. He was convinced that eventually the practical man would have to say that the theoretical man was the man who gave him the lead, and eventually he would have to follow. He felt that to-day they were at the parting of the ways, the parting from the old way which, unfortunately, they had experienced for so long a period, the period of depression. Personally he was not inclined to think that that depressed period would last very much longer. We were certainly on the upgrade, we were certainly beginning to see the light, and he sincerely trusted that in a very short time industry not only in Scotland but throughout the British Isles, would once more take its full part in the trade of the world, and that this great Empire would be able to show the whole world that we did not intend to be relegated to a back seat.

Scientific and Technical Institutions

In proposing the toast of "Scientific and Technical Institutions," PROFESSOR PERCY HILLHOUSE (President of the Institution of Engineers and Shipbuilders in Scotland) said that without such technical and scientific institutions the engineering industry would be in a very poor way. Somebody had said that night that a great many of these experiments were of no use, but scientists went ahead and made experiments, sometimes without knowing exactly what they were aiming at, but they got results, and often out of those results something very useful turned up. In the old days the rule of thumb was their main lead, experience was supposed to be of more value than theory, but nowadays technical and scientific institutions were in this country existing in great numbers. There was no science or industry but what had got its own technical institution, and these institutions did a great deal of good.

In calling upon Sir Arthur Huddleston to reply, the PRESIDENT conveyed the hearty thanks of the Institute to the Directors of the Royal Technical College for the assistance they had given to the Institute and the founding industry in general.

SIR ARTHUR HUDDLESTON (Director of the Royal Technical College), in responding to the toast, said the Technical College had always endeavoured to maintain a really close connection between teaching and research, as carried out in the College and in industry in all its phases. That connection began even before the College opened. After a brief outline of the origin of the Royal Technical College, Sir Arthur concluded by assuring them that the aim of the College had always been, and would continue to be, the maintenance of the closest possible connection with industry.

The Scottish Branch

The last toast, "The Scottish Branch of the Institute of British Foundrymen," was proposed in a few fitting words by MR. J. E. HURST, the Immediate Past-President of the Institute.

MR. DANIEL SHARPE (President of the Scottish Branch) suitably replied. On behalf of the Scottish Branch he assured them that they were delighted with the large number of members of the Institute attending the conference in Glasgow. He concluded with a brief outline of the activities of the Scottish Branch, and made reference to the very able work of the Scottish Secretary, Mr. John Bell, who had been responsible for the preparation and carrying out of all the arrangements, assisted very ably by Mr. A. Campion.

THE PRESIDENT said he desired to add his meed of praise and thankfulness to Mr. Bell and Professor Campion, a Scotsman and an Englishman, for their collaboration in the preparation of the programme. He was sure they were all agreed that once more England and Scotland had combined to make this function a complete success.

The President thereafter presented a beautiful silver tea service to Mrs. Hurst, the wife of the Immediate Past-President, as a little memento on behalf of the leading officials of the Institute of their appreciation of her services to them during her husband's year of office.

MRS. HURST suitably replied.

At intervals during the evening instrumental music was provided by Mr. Frank Merton and his orchestra, who also provided music for the dancing, which continued till 1 a.m. Vocal

selections were rendered during the evening by Miss Jean Dawson, Mr. Elliot Dobie and Mr. J. C. Dorsie.

VISIT TO EDINBURGH

On Thursday, June 11, the delegates and their lady friends paid a visit to Edinburgh, the nominal Capital of Scotland. Travelling from Glasgow by special train, the party on arrival in the Capital found a fleet of motor buses awaiting them. Here the ladies embarked on a sight-seeing expedition to the Forth Bridge, followed by a tour of the city, while the men drove to the Heriot-Watt College, where a Symposium on High Duty Cast Iron was contributed to in the form of Papers by Mr. J. E. Hurst, Immediate Past-President; Dr. H. Jungbluth, Essen; Dr. A. L. Norbury, British Cast Iron Research Association; and Mr. H. H. Judson, New York. Each Paper provoked an interesting discussion, and both the Papers and the discussions will be published in subsequent issues of THE FOUNDRY TRADE JOURNAL.

At the conclusion of the Conference the delegates drove to the Caledonian (L.M.S.) Hotel, Princes Street, where luncheon was served. Mr. A. D. Mackenzie, Chairman of the Edinburgh section of the Scottish Branch, presided, and after luncheon formally welcomed the visitors to Edinburgh. BAILIE STEEL, on behalf of the Town Council of the City of Edinburgh, also extended to the visitors a right royal welcome, and the PRESIDENT (Mr. H. Winterton), in acknowledging, remarked that he was not surprised to learn that the rudder of the "Queen Mary" had been made in Edinburgh.

After luncheon the members and their ladies were conveyed by bus to Edinburgh Castle, where a most enjoyable hour was spent in inspecting the congeries of ancient buildings which go to make up this hoary old castle which has played such a prominent part in the history of Scotland. The impressive Scottish National Shrine was also visited.

Civic Reception

The company thereafter proceeded to the City Chambers, where they were entertained at a civic reception by the Lord Provost, Magistrates and Council of the City of Edinburgh. In the unavoidable absence of the Lord Provost (Mr. Louis S. Gumley), the visitors were received and individually greeted by Bailie Aldridge, the senior Magistrate of the City, who was accompanied by most of the other Magistrates in their scarlet robes of office.

BAILIE ALDRIDGE said he was very pleased on behalf of the Corporation to welcome them to Edinburgh. The Lord Provost had asked him to express to them his great regret that he was unable to be present himself that afternoon. Bailie Aldridge went on to say that he understood that they were holding their annual Conference in Glasgow. Well, he had nothing to say against Glasgow; it was a very up-to-date and go-ahead city, which they in Edinburgh admired very much, but he thought they had acted very wisely in taking a day off and coming over to Edinburgh. His colleagues and he were very glad to welcome them and to greet them, and they hoped that their Conference was meeting with every success, and that the ideals of their Institute were being attained.

The PRESIDENT (Mr. H. Winterton) briefly acknowledged the welcome extended by Bailie Aldridge. He remarked that in the city of his adoption, Glasgow, they equally admired Edinburgh, but they regarded Glasgow as being the city of the workers, while they regarded Edinburgh as more of an ornamental city.

The reception was followed by a programme of instrumental music provided by the Monica-Orr Trio, while light refreshments were served to the visitors.

The company afterwards drove back to Princes Street Station, where they entrained for Glasgow, which was reached about 7.20 p.m.

Edward Williams Lecture

On Thursday evening, June 11, the second Edward Williams lecture was delivered in the Rankine Hall of the Institution of Engineers and Shipbuilders in Scotland, Elmbank Crescent, Glasgow, by Prof. A. L. Mellanby, D.Sc., M.I.Mech.E., Royal Technical College, Glasgow, his subject being "Cast Iron and the Engineer."

The PRESIDENT (Mr. H. Winterton), who presided, at the outset formally presented the Meritorious Service Medal to Mr. James Smith, South Shields. In paying a tribute to Mr. Smith's valuable services to the Institute, he mentioned that Mr. James Smith was a very old personal friend of his.

MR. SMITH, in acknowledging the gift, said he found great difficulty in expressing his feelings that night on receiving such an honour as had just been conferred upon him by the Awards Committee. It was entirely unexpected. He did not know what it was for yet, whether it was for being a good boy or a bad boy. He recalled that thirty years ago when the first convention was held at Glasgow there was not a branch in existence, but as time went on branches were formed in the different parts of the country, and the Institute of British Foundrymen had progressed ever since. He admitted that at one time he became a bit discouraged. He went on to outline the history of the Newcastle Branch, the membership of which, after a period of vigorous growth, began to decline, but during the past two years a determined effort had been made to bring the branch back to its former vigour, with such success that close on 60 new members had been installed during that period.

Prof. Mellanby then delivered his lecture, which will be printed in THE FOUNDRY TRADE JOURNAL in the near future.

Vote of Thanks

The PRESIDENT, in thanking Prof. Mellanby for his lecture, remarked that all practical men amongst them would agree that, at any rate on the theoretical side, those who were studying the various points did not save themselves any trouble in going most thoroughly into all the various problems that the practical man placed before them. He concluded by congratulating Prof. Mellanby on the fact that the University of Glasgow was just about to confer upon him the honour of Doctor of Laws.

MR. F. J. COOK proposed a hearty vote of thanks to Prof. Mellanby for his admirable lecture.

MR. DANIEL SHARPE, in seconding the vote of thanks, characterised the lecture as a pleasure to the old members of the Institute and an inspiration to the young.

The vote of thanks was enthusiastically accorded, and Prof. Mellanby briefly responded.

The PRESIDENT, in closing the proceedings, conveyed the hearty thanks of the Institute to the Directors of the Institution of Engineers and Shipbuilders in Scotland for the use of the Rankine Hall during the Conference.

Excursion by Steamer to Isle of Arran

Exceptionally fine weather favoured the closing day of the Conference, Friday, June 12, when 220 members and ladies participated in a most enjoyable excursion on the newest of the fleet of Clyde steamers, "The Marchioness of Graham."

The steamer departed from the Bridge Wharf in the centre of Glasgow, and passed down the Clyde through rows of shipyards, most of which are busier than they have been for years. Interesting points were the berth upon which the "Queen Mary" was built, and the fitting-out basin from which she commenced her voyage down the Clyde, and a little later on, the party saw the ill-fated "Atlantique."

A call was made at Gourock to pick up some of the party who had missed the boat, and to land some passengers who had boarded the vessel in mistake for the Queen Mary II!

The interesting industrial part of the voyage was left behind, and thence onwards, the trip was through some of the most beautiful scenery in the British Isles. After passing through the Kyles of Bute, the steamer turned into Loch Fyne, proceeding as far as Tarbert, then turned and cruised off the Isle of Arran, almost touching Loch Ranza. Again the vessel turned and steamed towards the mainland, and proceeded between the Cumbraes, then up Loch Long and Loch Goil. After a further cruise in Loch Long, the vessel roturned to Gourock where the party landed, and completed the journey to Glasgow by special train.

By reason of the very magnificent scenery on its boundary, Glasgow is in an exceptionally fine position for excursions of this kind, and the Institute has never participated in a more enjoyable excursion than that which concluded the 1936 Conference.

Before the termination of the voyage, the final meeting of the Conference took place on the covered deck of "The Marchioness of Graham." MR. D. SHARPE, President of the Scottish Branch, on behalf of the Branch expressed the hope that all the visitors had enjoyed their visit to Scotland as much as the members of the Scottish Branch had enjoyed the pleasure of entertaining them; he hoped they would all carry away happy memories of Scotland and of the Conference. He expressed his thanks to his fellow members of the Executive Committee, particularly to Mr. John Bell, the Secretary of the Conference, who had carried out most of the very heavy work of organising the arrangements.

MR. H. WINTERTON, President of the Institute, expressed the thanks of the Institute to the Scottish Branch, to the Reception Committee, to the Executive Committee, and particularly to Mr. John Bell, the Conference Secretary, and Mr. A. Campion, for the most successful arrangements which had been made for the Conference. Everyone present had had a very happy time, and fully appreciated all that had been done on their behalf. He called for three hearty cheers for Mr. Bell and Mr. Campion.

MR. JOHN BELL, who was received with musical honours, in reply paid a tribute to his colleagues in the Scottish Branch, to the Executive Committee, to the stewards, to his colleague Mr. Campion, and also to the forbearance of Mrs. Bell. If the work of the Scottish Branch had pleased those who had participated in the Conference, then the Scottish Branch was well repaid for all that it had done.

BAILIE MRS. MANN, of the Corporation of Glasgow, representing the Lord Provost of Glasgow, tendered the regrets of the Lord Provost at his inability to be present, and his good wishes for a happy termination to a successful Conference. The Corporation of Glasgow had passed a special resolution authorising fine weather for the day, and as was the case with all resolutions of that Corporation, it had been honoured to the letter! Scotsmen were sometimes accused of being boastful of the beauties of their country, but those who had been present on that day would surely agree that they had something to boast about.

MR. C. W. BIGG, Senior Vice-President, associated himself with the remarks of the President, and issued an invitation to all members of the Institute and their ladies to take part in the Conference in Derby in 1937.

Some Applications of Heat-Treated Cast Iron in France*

By MARCEL BALLAY and RAYMOND CHAVY, Paris, France

The application of the hardening heat-treatments, quenching and drawing to cast irons, is not a new idea in France. During the war years of 1914-1918, heat-treatment was tried for cast-iron shells containing a high percentage of steel scrap. Quenching and tempering was applied to an ordinary grey iron, but one which to-day probably would not be considered to be of the current ordinary types. Actually, the results were not satisfactory.[1] Water or oil quenching of ordinary cast iron, having too high a critical quenching speed, led to internal defects (microscopic cracks), and to porosity. However, Jean Durand,[2] in 1922, stressed the importance of the improvement in mechanical properties which could be attained by heat-treatment. With an iron containing 3.20 T.C; 0.48 C.C; 1.18 Si; 0.53 Mn; 0.048 S, and 0.208 per cent. P, oil quenched at 900 deg. C. and tempered at 650 deg. C., the breaking strength was increased from 14.2 to 19.8 tons per sq. in., and the total energy required to break the bars increased from 93 to 291 ft. lbs.

While the heat-treatment of ordinary cast irons can, in certain cases, give interesting results, it is the alloy irons, having a low critical quenching speed, which have created the interest shown to-day in this subject. These irons allow lower quenching temperatures and particularly far less exacting cooling conditions. Risks of cracks have been reduced, and heat-treatment can be applied to castings of complicated design. In 1928, the influences of manganese, silicon and nickel were defined in a Paper,[3] and the principal methods of heat-treatment applicable to cast irons classified. One of the writers cited this research work in a Paper[4] before this Association in 1932.

Applications of heat-treated grey irons can be divided into four groups:—

(*a*) Irons, machinable as cast, hardened by a water, oil, or air quench, according to the composition, size and sections of the casting. Tempering, even at low temperature, is always useful, reducing considerably the brittleness caused by quenching.

(*b*) Irons martensitic as cast, employed upon occasion as such, but more often after tempering between 492 and 650 deg. C. which results in a hardness of 300 to 340 Brinell, which still permits machining without excessive difficulty with this type of iron.

(*c*) Irons of the preceding group can be rendered machinable by tempering at 595 to 650 deg. C., then hardened by a treatment consisting of an air quench, or even relatively slow cooling in the furnace. This method is adopted for heavy castings, or those whose complicated design causes risks of deformation or cracks from quenching.

(*d*) Austenitic irons hardened, after machining, by tempering, transforming the austenite to martensite, have been proposed. One application has been cited[5] by Delbart and Lecoeuvre. To this group could be added precipitation hardening, which, however, has not been applied to date.

An attempt will be made in this Paper to describe a few French applications of heat-treated grey irons of the first two groups, (*a*) and (*b*), limiting them to those more important applications as have received practical industrial endorsement during the past several years. There are numerous other experiments under way which cannot be enumerated at the present time, through lack of space, concerning the solution of various diversified problems, including: diesel or internal combustion motor cylinder blocks, motor-cycle cylinders, motor cams, piston rings, cylinder rolls for small sectioned shapes, pump bodies handling abrasive liquids, pump pistons, forging and stamping dies, lathe mandrels, etc.

Replacement Automobile Cylinder Sleeves

The subject of automobile cylinder sleeves, has been recently treated in detail in an interesting Paper.[6] In France similar results have been obtained, and heat-treated sleeves have been rather extensively employed for the past five years. Numerous compositions have been tried for such castings. Among the most interesting and economical, due to excellent wear resistance, are the martensitic irons, treated after machining. The usual average composition is:—T.C 2.8 to 3.0, Si 1.5 to 1.8, Mn 0.8 to 1.0, P 0.30, Ni 2.5 to 2.8 and Cr 0.5 to 0.7 per cent.

These irons are usually produced in the cupola. The nickel and chromium additions are made in part to the charge in the form of risers, etc., and in part to the ladle in the form of nickel-silicon shot. An iron of the above composition is machinable as cast, the Brinell hardness being 270 to 300. The sleeves are generally cast with a collar at each end, to avoid any deformation which might be produced during machining or oil quenching. After machining, save for finishing, the castings are quenched in oil at 830 to 850 deg. C., then tempered at 250 to 300 deg. C. so as to relieve internal strains and brittleness. Allowance must be made in machining for a very slight increase in diameter (about 0.004 in. for a sleeve of 4-in. diameter). After complete treatment, the hardness is about 450 Brinell and the metal is practically unmachinable. Both interior and exterior finishing is accomplished by grinding, one of the collars being cut off at this time, and the other remaining as a reinforcement for pressing the liner into the cylinder.

The use of such heat-treated sleeves in France for re-boring both touring and commercial cars, is extensive, while certain manufacturers have even started employing heat-treated sleeves in new motors, taking certain special precautions as to cooling conditions for the cylinder top, this being more necessary in sleeved than in ordinary cylinders.

Ventilator Gears

In certain instances ventilator gears operate under very bad lubricating conditions, and even in the presence of fine abrasive matter, which accelerates wear of the teeth. Ordinary pearlitic irons of 180 and 220 Brinell have been found to be far from satisfactory, due to very rapid wear in service, while alloy steels entail a considerable increase in machining costs. Comparative tests on a test bench between a pearlitic iron, a self-hardening nickel-chromium steel and an air-quenched nickel iron, definitely indicated the superiority of the treated nickel iron as regards wear as well as cost (in comparison to the alloy steel). The approximate composition of this iron was:—T.C, 2.8 to 3.0; Si, 1.5 to 1.8; Mn, 0.8 to 1.0; P, 0.30; Ni, 2.5 to 2.8, and Cr, 0.5 to 0.7 per cent.

The metal, melted in a crucible, had a hardness of about 270 to 300 Brinell as-cast. For certain gears working under normal conditions with suitable lubrication, the castings are sometimes employed without treatment, while in other cases they are machined completely and then air quenched at 830 deg. C. and tempered at 300 deg. C. During the quench, the gear is mounted on a horizontal shaft turning slowly so as to effect a uniform quench of all teeth. Brinell hardness of the teeth can be from 360 to 420 without undue brittleness.

Ball Bearing Calibrating Plates

Castings such as ball bearing calibrating plates mounted in special machines, are subjected to excessive wear by the balls rolling under rather heavy pressure in the presence of powdered emery. Since the plates weigh from 330 to 550 lbs. each, their dissembling and machining is a costly item, and since the average service for such plates between rectifications was only about two days, a large number of machines were required to maintain normal production. Within the past few years, following trials with various materials, a nickel-chromium iron, martensitic as-cast and tempered to a Brinell hardness of about 340, has been employed, the composition being:—T.C (approx.), 3.2; Si, 1.5; Mn, 1.0; P, 0.4; Ni, 4.0, and Cr, 0.8 per cent.

Due to the weight of metal involved, this iron is produced in the cupola with a charge composed of risers and scrap from preceding melts, used plates, and a mixture of 2.5 per cent. chromium pig, ordinary hematite iron and silicon steel scrap (to lower the carbon content). To ensure a martensitic state as-cast, these large pieces are removed from the mould at a red heat about 45 minutes after pouring, that is, at a temperature around 815 to 900 deg. C. They are then placed in a well-ventilated section of the foundry floor to obtain as rapid cooling as possible. The hardness specified for each plate before tempering is over 360 Brinell, though usually, due to removal from the mould at a red heat, hardnesses of about 420 are obtained.

Tempering is a simple process, since there is no deformation to be feared. They are placed directly in a furnace heated to about 548 deg. C., held at this temperature for 2 or 3 hours and then are allowed to cool in the furnace, so as to avoid the possibility of any internal strains from rapid cooling, in view of the numerous refinishing operations required during service. The service life of these heat-treated nickel-iron plates has been found to average ten times longer than the ordinary iron plates of 180 to 200 Brinell previously employed, whereas the alloy iron, including the treatment, only costs two or three times more.

Cylindrical Supports for Grinding Bearing Rollers

The problem in connection with cylindrical support for grinding bearing rollers is similar to that of the calibration plates, except that cost of the finished parts is considerably higher due to the large amount of machining involved and the necessity of working within narrow tolerances. Treated chromium steels are sometimes employed for these parts, but usually a nickel-chromium iron of the same composition and treatment as that used for the calibration plates previously cited, is preferred. However, these parts, being much lighter in weight (65 to 110 lbs.) and in section, are allowed to cool in the mould, which suffices to obtain a martensitic quench and a Brinell hardness of 360. Being used in the same plant, tempering is done at the same time as the calibration plates.

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* Presented on behalf of the Association Technique de Fonderie de France to the Annual Meeting of the American Foundrymen's Association.

1 Portevin, A., "Sur le traitement thermique des pièces moulées et spécialement des projectiles en fonte dite aciérée," Comptes Rendus, vol. 175, 1922, p. 27.

2 Durand, J., "Sur le traitement thermique de quelques fontes de moulage," Comptes Rendus, vol. 174, 1922, p. 748.

3 Guillet, L., Galibourg, J., Ballay, M., "Sur les points critiques et la trempe martensitique des fontes au nickel et au nickel-chrome." Comptes Rendus, vol. 187, 1928, p. 14.

4 Ballay, M., "Contribution to Study of Martensite Quenching of Alloy Cast Irons," Trans. Am. Foundrymen's Assoc. (1932), vol. 40, p. 15.

5 Delbart and Lecoeuvre, "Etude de quelques propriétés physiques d'une fonte austénitique au nickel-manganèse à basse teneur en carbone," Bull. Assoc. Tech. de Fonderie, July, 1934, pp. 279–288.

6 Eddy, W. P., "Heat-Treated Grey Iron Cylinder Liners," Trans. A.F.A., vol. 42 (1934), pp. 129–147.

High Pressure Hydraulic Pump Pistons

High pressure hydraulic pumps operate at high water heads and under very heavy pressures of around 5 tons per sq. in. The piston plunger of a " double piston " type, is worn very rapidly by the packing, wear being accelerated by the presence of sand and rust particles in the water. Tests with case-hardened and even nitrided steels did not give good results. While a self-hardening, nickel-chromium steel stood up well, a grey nickel-chromium iron of martensitic structure was tried out with extremely interesting results. The composition was approximately:—T.C, 3.0; Si, 1.5; Mn, 1.0; P, 0.4; Ni, 4.2, and Cr, 0.8 per cent.

This iron is melted in the cupola with the nickel-chromium additions included in the charge. The larger pistons which weigh over 225 lbs. are removed from the moulds at a red heat, while those of smaller dimensions are allowed to cool normally in the mould. The as-cast hardness is 360 to 420 Brinell, and the pieces are employed after tempering at a very low temperature, 198 to 250 deg. C., in a drying oven. Machining is effected with tungsten carbide tools, with a final polishing operation on a precision grinding machine.

Air Cooled Aviation Motor Cylinders

Air cooled aviation motor cylinders present a rather difficult problem, since the iron must possess several distinctive and different characteristics which are:—(*a*) High mechanical properties permitting thin sections, and consequently lightness; (*b*) facility in readily casting the thin fins of 1.5 to 2 mm. (0.059 to 0.078 in.) thickness, which are in turn but 7 mm. (0.276 in.) apart; (*c*) excellent resistance to wear; and (*d*) excellent stability (no internal strains), to avoid deformation in service upon repeated heating and cooling.

To meet all these requirements, a low carbon iron has been employed, though as far as wear resistance is concerned, an iron of higher carbon might have been preferable. To obtain a high hardness, a martensitic iron, tempered before machining to a Brinell hardness of 300, has since been used. This iron has the following approximate composition:—T.C 2.8, Si 2.0, Mn 1.0, P 0.6 and Ni 4.2 per cent. It is melted in the crucible with a mixed charge of hematite pig and 1.5 per cent. phosphorus " PL-3 " pig.

Pouring is carried out at as high a temperature as possible, about 1,440 deg. C., into moulds, the essential parts of which are of a high silica sand bonded with linseed oil. The Brinell hardness as-cast varies from 360 to 420, and the iron can be machined and used in this state, but preferably is tempered at a temperature of 492 to 570 deg. C. to reduce machining time and suppress internal stresses. The cylinders are placed in the furnace cold, and heated very slowly for two or three hours up to the tempering temperature, at which temperature they are kept for about half-an-hour, following which they are withdrawn from the furnace and immediately placed in soaking pits to cool-very slowly. Such slow heating and cooling during the reheating operation is required due to the inevitable presence of cementite, producing cracks if more rapid operations are employed.

Despite a 0.5 to 0.7 per cent. phosphorus content in this iron, its mechanical properties after treatment are considerably above those specified in France for cast irons termed " high tensile." Brinell hardness is regulated between 280 and 320 and the transverse strength on a Frémont test-specimen varies between 1,430 and 1,670 lbs., as compared to a specification of but 1,200 lbs. for the so-called " high tensile " irons. Despite a rather low-carbon content, the iron also exhibits excellent wear resistance properties in service. After 700 hours of service, the cylinder diameters were found to be but a few hundredths of a millimetre (1 mm. equals 0.03937 in.) out of truth in the zone of maximum wear.

Cement Pump Bodies

Cement pump bodies previously were made of ordinary grey cast iron or cast steel and wore very rapidly, due to the abrasive action of the sand grains contained in the concrete moving through these parts. Successful tests were made with a martensitic iron containing about 4.2 to 4.5 per cent. nickel, 0.6 to 0.8 per cent. chromium and 1 per cent. manganese, which is hard and unmachinable in the as-cast condition. Before machining, the pieces were reheated at a temperature of between 600 to 620 deg. C. to obtain a maximum softness. The pieces were then completely machined and quenched in still air at 850 deg. C., this being followed by reheating to 200 to 250 deg. C. After this treatment, the Brinell hardness was between 400 and 450. Improvement in wear resistance has been considerable, and the increased service life of these parts has been such that a very important economy has been recorded.

Rollers for Weaving Looms

Rollers for weaving looms are machined all over and wear rapidly due to the contact of the outer part upon the roller race. Until recently, they have been cast in ordinary grey pearlitic cast iron of 200 to 230 Brinell. A test was made on about 100 castings with a grey nickel-chromium cast iron of martensitic quench, of the following composition:—C 3.0 to 3.3, Si 1.5 to 1.8, Mn 0.8 to 1.0, P 0.3, Ni 2.5 to 2.8 and Cr 0.6 to 0.8 per cent.

The hardness of this iron in the cast state was about 270 to 300 Brinell and machining could be carried out in the ordinary way. After machining, the castings were quenched in still air at 850 deg. C., then reheated to about 250 deg. C. to obtain a Brinell hardness of 400, and finally ground on the outer surface and in the bore. Results obtained in service have been excellent. The life of the castings has been increased more than five times the average service life. This solution has been turned to good account in the spinning mills which have made the experiments.

Conclusion

When first proposed, the heat-treatment of cast irons was considered to be an operation replete with difficulties and troubles. Actually it is becoming a readily controlled solution to the problem of obtaining hard or very hard machinable grey irons, for which purpose alloyed irons offer particular advantages. Numerous articles on this subject have been written during the past seven years, citing a wide range of applications, which have proved that the idea is gaining headway, and that heat-treatment can be applied equally as well to cast irons as to steels. In this Paper the authors have sought to describe only certain definitely proved French applications.

All of the possibilities of this method of hardening machinable irons have not yet been utilised. In closing, attention is drawn to two important points:—

(1) Quenching is most often utilised for increasing the hardness, the improvement in other mechanical properties being considered as secondary. It is true, of course, that a high-quality iron with or without alloy additions will produce higher strength, transverse and shearing values than a mediocre iron, when treated. However, mechanical properties of the best irons can be still further improved by a judicious heat-treatment, thereby elevating very considerably the upper limit of mechanical properties obtainable.

(2) With unalloyed irons, when it is desired to increase the hardness and mechanical properties, it is necessary to lower the carbon, that is to say, the proportion of graphite. When only compression, transverse, tensile and shearing strengths are of importance for the castings to be made, there is no disadvantage, but if good friction and wear resistance is required, a certain quantity of graphite is necessary. For numerous applications involving wear, the best irons are those which are hard and contain a considerable amount of graphite. These two conditions are contradictory in the case of ordinary irons, but can be readily realised with alloy irons subjected to heat-treatment.

Only one example is cited, referring to an iron containing:—T.C 4.08, C.C 0.60, Gr. C 3.48, Si 1.52, Mn 0.88, Ni 4.69 and Cr 1.05 per cent., cast in test bars of 40 mm. (1.57 in.) diameter. With no alloys present, a grey iron of the same graphitic carbon content would have a Brinell hardness of about 160, while the iron alloyed with nickel-chromium has an average Brinell hardness of 270 as cast.

Art in the Light Castings Industry

At a recent meeting called under the auspices of the British Ironfounders' Association and held in Glasgow, the subject of art in industry was discussed, with particular relation to the light castings industry. Sir Steven Bilsland presided. In the discussion the importance of the application of art to industry was stressed, and reference made to changing tastes in the matter of house decoration. It was pointed out that in the design of grates, for example, the modern demand was for something which combined the artistic with the practical. The present-day preference for delicately-coloured and artistically fashioned all-tile fireplaces was having its effect on the light-castings trade, and ironfounders should not allow this profitable branch of the industry to slip from them.

MR. J. COUTTS MORRISON, of the Stirlingshire Education Committee, reminded the manufacturers that only four years ago his committee had built in Falkirk, at a cost of £100,000, a technical school, a feature of which was the inclusion of a foundry department complete with metal and wood pattern shops, foundry with cupola house containing two small cupolas for the melting of cast iron and pot furnaces for the melting of different materials, as well as engineering and motor mechanic shops and foundry laboratory. He feared that advantage was not being taken of this valuable feature. Manufacturers were not encouraging the use of it to the extent that was possible, and there was the danger of the school developing into an establishment for training along purely commercial instead of practical lines. They wanted to inculcate in the rising generation creative ideas and a desire to combine the practical with the artistic in manufacture. He appealed to the ironfounders present to lend what aid they could in furthering the purpose for which this foundry department in Falkirk Technical School had been introduced.

The subject was discussed at length and various helpful suggestions made, and members of the British Ironfounders' Association are to hold another meeting in Falkirk Technical School, where the manufacturers will themselves be able to inspect the existing facilities.

Company Meeting

The statutory meeting of Marshall, Sons & Company (Successors), Limited, was held on June 10 at Britannia Ironworks, Gainsborough. MR. ASHLEY S. WARD presided in the absence through illness of the chairman, Mr. Joseph Ward. It was announced that the company's order-book to-day stood 50 per cent. higher than it did when the works were taken over, and the turnover was steadily increasing. They possessed a large boiler shop and equipment, and it was encouraging to find that in this department they were practically working to full capacity.

British Non-Ferrous Metals Research Association

The annual meeting and luncheon was held last Monday at the Savoy Hotel under the chairmanship of Mr. Thomas Bolton, who in his speech made reference to the desirability of increasing the output of fundamental research.

The sixteenth annual report shows that excellent progress has been made in every direction, and, as the following extracts from it show, increasing interest is being taken in foundry practice.

The Report for the previous year referred to the probability of increased accommodation being required in the future, but the need has arisen sooner than was expected. The leasehold building at present occupied as the Association's laboratories and general headquarters now houses a staff of 50, although a considerable part of the total floor area of some 10,000 sq. ft. is occupied by machines and other equipment, the Development exhibition and storage. Certain sections of work in progress are limited by insufficiency of space, particularly those such as foundry and machine work, which can only be accommodated satisfactorily on the lowest floor, and the chief limitation on the installation of new equipment required is the difficulty of finding room for it.

Some relief is provided by utilising extra-mural facilities; additional work has been placed during the year at the Research Department, Woolwich, while arrangements have been made to start an investigation on a new subject at the Imperial College of Science and Technology. The Association proposes to co-operate, financially and otherwise, in a research on Deep Pressing of Metals, which is being organised by the Research Committee of the Institution of Automobile Engineers; the experimental work is to be done at Sheffield and at Swansea. It is contemplated that further new extra-mural work will be put in hand in the near future.

The Council and Director are giving the fullest consideration to the question of accommodation, and it is hoped that a definite scheme will materialise during the coming year.

Internal improvements and alterations made during the year at Regnart Buildings, because of changes in the character of the work, include the partioning-off of a Physics Laboratory and an extension of the library. The Development exhibition, which many members regard as a particularly interesting and valuable feature of Headquarters, has had to be reduced considerably in extent to provide space urgently needed for experimental work.

Research Programme

Work has begun on a number of items selected from the long-range programme prepared in the previous year, and progress has been made in the researches on corrosion of copper, the effect of cast structure on rolling properties, and the origin and control of shrinkage and gas cavities in tin bronzes, while new sections of electro-deposition work have been started. Seventeen major researches were being actively and continuously pursued at the end of the year, while preliminary or occasional work was in hand on several others.

It has for some time been suspected that biological factors may play a part in corrosion occurring in waters, such as sewage-contaminated estuarine waters, in which living bacteria or other organisms are present. Plans were prepared, towards the end of the year, for attacking this problem as affecting condenser tubes, and work is to be started shortly in the biological laboratories of the Royal College of Science, South Kensington, under Dr. S. G. Paine, who has investigated with marked success the comparable problem of the destruction of building stone, through bacterial action, in the atmosphere.

During the year the principal work of the research on aluminium castings has been concerned with the subject of grain refinement and the development of a combined degassing and grain refining process. Further work has also been carried out on problems connected with the degassing of silicon-aluminium alloys. A final report on the deterioration of aluminium and its alloys as shown on remelting subsequent to exposure to a corrosive environment has been made available to members. The patent covering the Association's process for degassing aluminium and its alloys has been completed.

A Sub-Committee for a research upon the melting and casting of bronzes was formed in 1935 under the chairmanship of Mr. A. J. Murphy. A programme of experimental work was drawn up and the research is now in active progress. Preliminary work has been carried out with a view to ascertaining the properties of gas-free pure bronzes. With the technique employed some high density and strength figures have been obtained. A primary object has been the standardisation of methods employed, and it has been found possible to repeat, within close limits, the figures obtained. It is hoped by this means to ascertain accurately the influence of external factors, particularly gas atmospheres, on the physical and mechanical properties of pure tin bronze (90 : 10) and phosphor bronze.

A Sub-Committee under the chairmanship of Mr. W. T. Griffiths has been formed for a research upon the casting of nickel silver. Preliminary work is being carried out by means of a review of the literature and the collection of information from interested members, with a view to defining the scope of the research and drawing up a programme of experimental work.

Council, Officers and Committees

Towards the close of the year the Council received with great regret the resignation of Mr. A. H. Wolseley from the office of hon. treasurer, which he had occupied since 1921, and from the Finance and General Purposes Committee of which he had acted as chairman since the retirement of Mr. R. A. Ernest Payne from the chairmanship.

The Hon. R. M. Preston, D.S.O., of the Rio Tinto Company, Limited, was unanimously elected to succeed Mr. Wolseley as hon. treasurer.

At the same meeting of Council the number of Vice-Chairmen was increased by the election of the following:—Mr. R. Lloyd Gibbins, Sir Harold Hartley, F.R.S., Mr. W. Murray Morrison, Mr. H. S. Tasker and Mr. A. H. Wolseley.

During the year vacancies on the Council were filled by the election of Mr. F. C. Braby (Messrs. F. Braby & Company, Limited), Sir Ronald Charles (British Aluminium Company, Limited), and Mr. A. J. Murphy (Messrs. J. Stone & Company, Limited).

The Finance and General Purposes Committee was reconstituted under the chairmanship of Mr. R. Lloyd Gibbins, Mr. W. H. Henman being elected vice-chairman. Mr. W. R. Barclay, Dr. H. W. Brownsdon and Mr. A. Dando were appointed to the Committee, which the Hon. R. M. Preston (treasurer) joined *ex-officio*, while Mr. H. W. Clarke continued his membership.

Staff

The changes in the Association's staff since the issue of the previous Annual Report have been more extensive than usual, mainly because of the expansion of work.

Dr. I. G. Slater, whose work with Prof. Hanson on the Aluminium Founding research resulted in the B.N.F. Degassing Process for castings of aluminium and its alloys, left to take up an important metallurgical research appointment under the Admiralty. Mr. F. A. Champion, B.Sc., who has been engaged on corrosion research (condenser tubes and copper) has been appointed to a post with the British Aluminium Company.

Ten new appointments have been made in all in the clerical and workshop staffs, mainly in consequence of resignations.

The Association's staff now numbers 52.

Publications

As this Annual Report goes to press, the publication is announced of a German translation of B.N.F.M.R.A. Research Monograph No. 3, "The Casting of Brass Ingots," by R. Genders and G. L. Bailey; this translation, having the title "Das Giessen von Messingblöcken," is published by Julius Springer, Berlin. Messrs. H. & W. Engelhardt, from whom the suggestion for the German edition emanated, carried out the translation, receiving a good deal of assistance from the B.N.F.M.R.A. Information Department, and particularly from Mr. H. E. L. Freytag of that Department. The German edition has an interesting translators' preface, an English version of which was published in "B.N.F.M.R.A. Bulletin," No. 86, April, 1936, pp. 3-4.

British Foundry School

The B.N.F.M.R.A. has contributed during the year a small sum towards the general funds of the newly formed British Foundry School. This School was established (largely on the initiative of Mr. J. G. Pearce, Director of the British Cast Iron Research Association) for the purpose of the further training of men who wished to qualify for or had achieved positions of responsibility in the foundry industry, and fills a notable gap in the previously existing facilities for technical education in this country. The School opened in September, 1935, and the first session promises to prove very successful. In addition to the lectures given by the full-time permanent lecturer, the students have attended many lectures on special subjects connected with the foundry industry given by visiting lecturers having expert knowledge in particular fields. During the first year's session a number of these lectures (eight in all) were given by members of the staff of the B.N.F.M.R.A.

During the year an important part of the activities of the Association has been concerned with putting into effect the recommendations of the Research Programme Revision Committee. In all, nine new researches were recommended for inclusion in the programme for 1935. In nearly every case good progress has been made in planning the research and carrying out preliminary investigations, and in several of them a good start has been made on a definite programme of work.

Two new Research Sub-Committees have been formed as follow:—Research No. 54—Melting and Casting of Bronzes (chairman, Mr. A. J. Murphy) and Research No. 55—Casting of Nickel Silver (chairman Mr. W. T. Griffiths).

Iron and Steel Output in May

The British Iron and Steel Federation states that there were 112 furnaces in blast in Great Britain at the end of May, three having been blown in and three put out of operation during the month. The production of pig-iron in May amounted to 661,000 tons, compared with 629,800 tons in April and 558,900 tons in May, 1935; the month's production includes 150,200 tons of hematite, 360,100 tons of basic, 123,500 tons of foundry, and 11,900 tons of forge pig-iron. The production of steel ingots and castings in May amounted to 963,000 tons, compared with 984,200 tons in April, 1936, and 853,300 tons in May, 1935.

Twelfth International Congress of Acetylene and Oxy-Acetylene Welding

BANQUET IN LONDON

The Banquet of the Twelfth International Congress of Acetylene, Oxy-Acetylene Welding and Allied Industries, as briefly reported in our issue of last week, was held in London, at Grosvenor House, on June 9.

Acetylene Associations Abroad

The loyal toast having been honoured, MR. A. B. HARROWER proposed the toast of the "Continental, American and other Acetylene Associations," and expressed the pleasure of the British Association at the presence of distinguished representatives from so many countries. He recalled the fact that the Swiss Association had celebrated this year the twenty-fifth anniversary of its foundation, and mentioned that when attending the Convention of the American Association in Cleveland last November he had been accorded the distinction of honorary membership, an honour to the British Association and to himself which he greatly appreciated. Continuing in both French and German, Mr. Harrower expressed the hope that all the visitors from abroad would carry away with them pleasant recollections both of the utility of the work of the Congress and of the hospitality which their British hosts had endeavoured to extend to them.

M. GANDILLON (President of the Permanent International Acetylene Committee and of the Swiss Acetylene Association) thanked the British Association for their hospitality, and complimented them on their remarkable organisation of the Congress. The Swiss Association, when celebrating its twenty-fifth anniversary at Basle a few weeks ago, had the honour of welcoming a delegation from Great Britain, headed by Major Raikes, whose presence afforded tangible proof of British goodwill. The Congress was not only of great technical and scientific interest, but afforded the delegates from abroad the opportunity of visiting London, of renewing old friendships and forming new ones, and of seeing something of the beauties of England in the spring.

M. GRANJON, responding on behalf of the French delegates, expressed their thanks for the hospitality accorded to them and for the admirable work done by the Organising Committee of the Congress. M. GEORGES, who also replied, recalled the lines: "'Tis not in mortals to command success, but we'll do more, deserve it," and said that the organisers of the Congress had both deserved and obtained success; and to obtain so great a success in spite of the difficult times through which the world was passing was doubly to deserve it.

HERR DR. RIMARSKI, replying on behalf of the German delegates, also thanked the organisers of the Congress for all that they had done and for the success which had crowned their efforts, and referred to the remarkable development which the industry had undergone.

M. CARIS, on behalf of Belgium, said that the British industry, at present celebrating the fiftieth year of its foundation, had taken a leading place in the great oxy-acetylene family of the world. It was well to recall, as an inspiration to the younger generation, the names of some of those pioneers who were justly honoured by their country because of the honour which they themselves conferred upon her. The Belgian delegates were happy to salute the great names of Humphry Davy, Ramsay, Andrews and Dewar, names that belonged not to one country only but to the science and history of the world. Their work had been worthily continued by their successors, Murray, Bingham, Allen, Liversidge, Pollock, and many others whom the Belgian delegates regarded with respect and admiration. The present Congress was largely the result of the work of three men, Major Raikes, Mr. Amodeo and Mr. Harrower, whom all the delegates would wish to thank for their admirable work. The delegates from abroad would always remember the generous hospitality and cordial collaboration which they had found in England.

DR. A. B. KINZEL said it was his good fortune to be the last of the speakers to respond to the toast, a position probably accorded to him because the American Association had been the last to join the Congress. He regretted that he had to speak in a foreign language—American—but he brought to the Congress the greetings of the International Acetylene Association of New York, the American Institute of Metallurgical Engineers, the American Welding Society and the American Society for Metals, and also the personal greetings of one who was well known to most of the delegates, Dr. Moorhead. Mr. Harrower had referred to the honorary membership conferred upon him on the occasion of his visit to the Convention in Cleveland last year, and personally he would like to say that it had been a real pleasure to bestow that honour on one who was worthy of it. Meetings such as the present Congress, international in scope, served to emphasise the brotherhood of scientists and engineers, to bring together men who would otherwise only have read of each other, and to clear up misunderstandings of a technical nature and, by so doing, misunderstandings of a diplomatic nature.

British Dominions Acetylene Associates

MAJOR C. P. N. RAIKES, M.C., then proposed the toast of the "British Dominions and Overseas Acetylene Associates," and remarked that it was now thirty-six years since he started travelling round the world. He was still doing so, and had made innumerable friends in many parts of the Empire. His first visit to South Africa was made during the Boer War, but what he saw gave him a great desire to revisit that country. Twenty-five years elapsed before he was able to do so, but he was then able, in conjunction with Mr. Harvey Shacklock, to form a company for the production and distribution of oxygen and acetylene which had developed into a very important and successful concern, with production and distribution stations stretching from Capetown to Northern Rhodesia and East Africa, and capable of meeting all the demands made upon it. His first visit to Canada had been in 1904, when he spent four happy years in that Dominion. In those days the oxy-acetylene process was almost unknown. The next great country to which he wished to refer, India, differed in almost every respect from the other Dominions; instead of having sparsely-populated territories it had a teeming population of some four hundred millions. It was primarily an agricultural country, industries being of recent development, but the acetylene industry had producing stations all over the peninsula, from the Punjab to Ceylon and from Bombay to Burma. There were no representatives of New Zealand present, but a message had been received from Mr. Edmondson wishing the Congress every success. It was Mr. Edmondson who started the industry in New Zealand many years ago, and he was still at the helm. So far as Australia was concerned, the Congress was fortunate in the presence of four directors of the company which was developing the industry in that Dominion, one of whom, Mr. Hardie, would deal with its progress and development.

MR. J. MARCH HARDIE, who responded, said one of the proudest privileges of those who lived in the Dominions was to be able to come home to this country. They had the advantage of speaking its language and of knowing its customs, good and bad, having adopted most of them in their own lands; but their greatest advantage lay in the kindness and hospitality which they invariably received. It was said from time to time that the British Empire was falling from her high estate and that her industries were being filched from her by more vigorous competitors, but those who came to Great Britain with an open mind would find no evidence of lack of progress, and certainly there was no evidence of lack of progress in the great acetylene industry. He would like to extend a cordial invitation to those in Great Britain to visit the Dominions and become acquainted at first hand with the conditions there, thus affording the people of the Dominions an opportunity of repaying the generous hospitality they always received in the mother country and doing something to facilitate social and business relations between the different parts of the Empire.

MR. H. E. MUSSET, who all replied, said that, as representing Canada, it might not be out of place to refer to the position there of one of the important industries concerned with the Congress, the carbide industry. It was in 1892 that Thomas Wilson, a Canadian, in the presence of Major Moorhead and Mr. J. C. King, completed an experiment which was in fact the first manufacture of carbide in the electric furnace on a commercial scale. Thereafter he erected his first carbide works in Canada. It was small compared with modern carbide plants, having only two or three small furnaces each with a capacity of 500 lbs. per day. Apart from oxy-acetylene welding, during the war there was another development in the use of acetylene, the synthesis of acetylene and the acid aldehydes, leading to a long chain of synthetic organic chemicals, a branch of production likely to become one of the largest consumers of carbide and acetylene. Canada wished the Congress every success, and hoped it would lead to more friendly relations between all those engaged in the industry throughout the world.

Toast of the President

HERR E. THOMANDL, who proposed the toast of "The President of the Congress and of the British Acetylene Association," said it was impossible to deal in any detail with the work done by the British Association during its long and honourable existence, but there was one remarkable fact about it which was worthy of particular reference, namely that although England was not a carbide-producing country, the prestige of the British Acetylene Association was known throughout the civilised world, and its rules and regulations showed such wisdom that they had been widely adopted abroad. The Association had had many noteworthy Presidents, and was fortunate in having as its President for the current year Dr. Pollock, one of great attainments and vast experience who, in spite of the many calls on his time, had been able to devote part of his activities to the work of the Association. Another name well known to all the delegates and synonymous with progress in the acetylene industry was that of Mr. Liversidge, a past-president of the British Association and a vice-president of the Congress, whose services to the industry had been invaluable. He welcomed the opportunity, on behalf of the industry throughout the world, of paying a tribute to the work of the British Acetylene Association.

The PRESIDENT (Dr. J. D. Pollock), in reply, said the Congress had afforded him the opportunity of making many friends in very many countries of the world, and he was grateful for the kind things which had been said about himself and about those responsible for the organisation of the Congress. The greatest achievement of the Congress was that it enabled the delegates to get to know one another and to become friends; it taught them how much they all had in common, which was the surest basis on which to build friendship. He hoped the Congress would promote personal friendships and international friendships which would be for the future good of the whole world.

Open-Hearth Furnace Bottoms

Building a new bottom in an open-hearth furnace is an important operation because the quality of the steel made on such a hearth in succeeding years may depend on how carefully the bottom was sintered into place, states L. F. REINARTZ, in a Paper presented before the American Iron and Steel Institute recently. High-grade, sized magnesia is mixed with 15 to 20 per cent. clean, ground open-hearth slag. A ¼-in. to ½-in. layer is sintered all around the banks and on the bottom directly on the chrome or magnesite brick bottom. Each batch is heated until it is properly sintered. This operation is continued until a homogeneous hearth 12 in. thick or more has been sintered in. Then the furnace is cooled down to about 1,090 deg. C., and after that heated up again. Now about 9 tons of lump slag are charged into the furnace and melted. The molten slag is rabbled over the banks and then tapped out. After cooling the furnace for about an hour, it is heated up again. The furnace is now ready for operation. As each heat is tapped care must be taken to drain the bottom completely. All puddles of steel and slag must be removed.

Do you get tests like THESE ?

TALBOT-STEAD TUBE CO., LTD., BIRCHILLS, WALSALL. May 27th, 1935.

REPORT ON SPECIMENS TESTED

Tests of Malleable Cast Iron for Messrs. A. H. Mould.

Marks on Specimens	Dimensions of Specimens in inches			Tensile Strain in Tons—Ultimate		Elongation in 2 ins. Per Cent.	Contraction		
	Outside Diam.	Inside Diam.	Area	Total	Per Sq. Inch		Diam.	Area	Per Cent.
W. W.	.585	—	.268	5.83	21.75	23.0	—	—	—
S.A.W.	.585	—	.263	5.68	21.20	20.0	.51	.204	24.0

Tested in the Presence of .....

Test House Manager .....

The tests obtained by Messrs. A. H. Mould & Sons, Ltd., on crucible melted malleable castings—elongation 23% with tensile strength 21 tons per sq. inch, shown on the test certificate reproduced above, are evidence of the extremely high properties characteristic of "UCO" All-Mine Pig Irons.

"UCO" irons are produced from molten blast-furnace iron, and are not "synthetic" or "refined" irons; they contain no remelted scrap, pig or admixed steel.

Obtainable in "MW" grades, for malleable castings, or "W" grades for cylinder and similar work in the form of machine cast slabs.

THE UNITED STEEL COMPANIES LTD

"UCO" ALL-MINE PIG IRONS

"MW" GRADES FOR MALLEABLE CASTINGS

WORKINGTON IRON & STEEL COMPANY

Branch of The United Steel Companies Limited

WORKINGTON CUMBERLAND

W.29

Oxy-Acetylene *v.* Electric Arc Welding

A COMPARISON OF COSTS

In a Paper entitled "Comparison between the Results Obtained with Modern Methods of Oxy-Acetylene Welding and Electric Arc Welding," read by M. R. MESLIER (Director of Works at the Office Central de l'Acétylène et de la Soudure Autogène) before the Twelfth International Congress of Acetylene, Oxy-Acetylene Welding and Allied Industries, held in London last week, the author examined and compared the results obtained by the electric arc and the oxy-acetylene processes when used in accordance with established technique for making butt welds on steels in common use. Comparative results for fillet welds were not included because, for material above 8 g. thickness, electric arc welding has, undoubtedly, advantages when making this type of joint. On the other hand, for the welding of thin sheets or plates, it is always advantageous to use the welding blowpipe. For this application, and for the same conditions, the preparation need not be so exact and the final result is more economical.

In order to facilitate comparison of the results obtained with the two processes under conditions normally comparable, the welds are classified into two categories each corresponding to a well-known field of application: (1) High quality welds which must possess all the properties required of the parent metal and, consequently, must be perfect from every point of view; (2) ordinary types of welds which must possess such properties of the parent metal as to give adequate and satisfactory service.

In the examples which follow, the actual costs for making a weld 1 m. long, with suitable preparation of the edges according to the thickness of the metal, the method and process applied are given.

In the calculations, acetylene was reckoned at 5 fcs. per cub. m., the oxygen at 4 fcs. per cub. m., and the welding rod at 2.50 fcs. per kg. when A40 (tensile strength 22 tons per sq. in., elongation 20 per cent. on gauge length = $\sqrt{66.67}$ area) metal is used, and at 6 fcs. per kg. for A50 (tensile strength 28 tons per sq. in., elongation 14 per cent.) metal. Labour was reckoned at 6 fcs. per hr. and 100 per cent. general costs added to the labour item. Electric current was calculated at 60 centimes per kw./hr., and the cost of electrodes, according to diameter and quality, was based on the following factors: Electrodes with thin 3 mm. coating = 17 centimes; 4 mm. = 20 centimes; 5 mm. = 30 centimes. Good-quality electrodes with volatile coating: 3 mm. = 30 centimes; 4 mm. = 40 centimes; 5 mm. = 60 centimes.

High-Quality Welds

OXY-ACETYLENE WELDING. ELECTRIC ARC WELDING.

Plate Thickness 5 mm.

Upward vertical welding, Method "A," plates not chamfered. Welding rod A40.		Welding in two runs. Plates chamfered 60° V. Electrodes, 3 mm. volatile coated.	
	frs.		frs.
Labour	6.00	Labour	4.60
Gases	1.60	11 electrodes of 3 mm.	3.30
Welding rod ..	0.45	Current	0.65
		Preparation and chipping	1.20
	frs. 8.05		frs. 9.75

The oxy-acetylene welding data was obtained from practical results in well-organised workshops. As regards arc welding, the figures are those obtained for welds made on strips of sheet or plate, which means that they are slightly more advantageous than the results obtained in the construction of articles of more or less complicated profiles. The oxy-acetylene welding is definitely more advantageous for all thicknesses, even in cases where an expensive welding rod is used, as for instance when welding thicknesses above 6 mm.

OXY-ACETYLENE WELDING. ELECTRIC ARC WELDING.

Plate Thickness 15 mm.

Upward vertical welding Method "C" on double-bevelled plates. Welding rod A50.		Welding in six runs with electrodes of 4 and 5 mm. on double-bevelled plates 70° angle with slight spacing.	
	frs.		frs.
Labour	14.80	Labour	18.00
Gases	5.30	10 elect. of 4 mm. / 14 elect. of 5 mm.	12.40
Welding rods ..	5.00	Current	2.70
Preparation and chipping ..	2.40	Preparation and chipping	3.00
	frs. 27.50		frs. 36.10

Plate Thickness 25 mm.

Same method as for 15 mm.		Same method as for 15 mm.	
	frs.		frs.
Labour	28.00	Labour	30.00
Gases	15.60	10 elect of 4 mm / 36 elect. of 5 mm.	25.60
Welding rod ..	12.00	Current	6.00
Preparation and chipping ..	3.60	Preparation and chipping	4.20
	frs. 59.20		frs. 65.80

Plate Thickness 30 mm.

Same method as for 15 mm.		Welding in 8 runs with electrodes of 4 and 5 mm on plates double-bevelled 60° V.	
	frs.		frs.
Labour	40.00	Labour	45.00
Gases	24.50	12 elect. of 4 mm. / 60 elect. of 5 mm.	40.80
Welding rod ..	20.00	Current	10.00
Preparation and chipping ..	4.00	Preparation and chipping	4.60
	frs. 88.50		frs. 100.40

Ordinary Types of Weld

When dealing with the ordinary type of weld, the difference in cost price between these two processes is considerably less and only becomes appreciable when the thicknesses reach or exceed 4 mm. This difference would be more prominent if account were taken in the case of arc welding of the difficulties encountered in the preparatory work and the very great care required in preparing the edges, tacking, etc.; the preparatory work for oxy-acetylene welding is much simpler.

The gross cost price for the two processes, neglecting the differences in cost of preparation, would be as follows:—

OXY-ACETYLENE WELDING. ELECTRIC ARC WELDING.

Plate Thickness 4 mm.

Inclined leftward welding with A40 welding rod.		Welding in one run with 4 mm. electrodes, thin coated.	
	frs.		frs.
Labour	4.00	Labour	3.60
Gases	1.30	5 electrodes of 4 mm.	1.00
Welding rod ..	0.40	Current	0.45
	frs. 5.70		frs. 5.05

The position is quite different as soon as the thickness admits of oxy-acetylene welding being carried out according to modern methods and technique; *i.e.*, "rightward" welding, upward vertical welding, method "B." Where these methods are used on plates 6 mm. and 8 mm. thicknesses, the cost price per metre run of weld, always for welds of comparable quality, would be as follows:—

OXY-ACETYLENE WELDING. ELECTRIC ARC WELDING.

Plate Thickness 6 mm.

Rightward welding; plates chamfered to 80°. Welding rod A40.		Welding in two runs; plates chamfered 60° with 4 mm. electrodes, thin coated.	
	frs.		frs.
Labour	4.00	Labour	5.00
Gases	1.60	9 electrodes of 4 mm.	1.80
Welding rod ..	0.70	Current	0.75
Preparation and chipping ..	1.20	Preparation and chipping	1.20
	frs. 7.50		frs. 8.75

Plate Thickness 8 mm.

Upward vertical welding, method "B." Welding rod A40.		Same method as for 6 mm.	
	frs.		frs.
Labour	8.80	Labour	8.00
Gases	1.60	15 electrodes of 4 mm.	3.00
Welding rod ..	0.90	Current	1.35
		Preparation and chipping	1.60
	frs. 11.30		frs. 13.95

In the case of the 8 mm. plate, the objection that the quality of the welds obtained is not comparable might be raised because the method selected for blowpipe welding gives welds that are perfect from all points of view.

When applying carbon arc welding in which the electrode is a graphite rod, the welds are made either with a welding rod, or without by simply melting the edges, and it is this latter method which would appear of particular interest for repetition work, in which the pieces do not need to be joined by high-quality welds. Welds, with or without welding rod, are made with equipment which is cumbersome and costly. Further, it is found that the technical and economic results, at any rate as far as butt welds are concerned, are not commensurate with the outlay. The following are results obtained with a carbon arc-welding installation, working under the most satisfactory conditions.

Thickness of material welded. mm.	Welding speed metres/hour.	Cost per metre, in francs.
2	30	0.50
4	18	0.95
6	12	1.60
8	8	2.50

The following results were obtained by automatic oxy-acetylene welding in a workshop which manufactures by repetition, leak-proof tanks, not subjected to very great stresses.

Thickness of material welded. mm.	Welding speed metres/hour.	Cost per metre, in francs.
2	30	0.40
4	15	1.00
6	10	2.20
8	7.5	2.90

These results were obtained by using a ten-flame blowpipe (nine for preheating and one for welding), followed by an additional air-acetylene flame to protect the melted metal.

NOTICE of an intended dividend is given by the Darlington Rustless Steel & Iron Company, Limited. The last day for receiving proofs is June 23 next. Mr. H. A. Sisson, 16, Market Street, Newcastle-upon-Tyne, is the liquidator.

CUMMING'S BLACKINGS
ARE
THE BEST

Extract from daily report by one of our travellers:—

January 9th, 1936.

Mr. C..... said,

"I shall send on to you every time. Since we adopted your Blacking the skin of our castings has improved by 100 per cent. Our customers were the first to notice it."

NEED WE SAY MORE

All our productions are carefully graded, tested and manufactured.

WM. CUMMING & CO., LTD.

KELVINVALE MILLS, Maryhill, Glasgow, N.W.
SUNNYSIDE BLACKING MILLS, Falkirk.
WHITTINGTON MILLS, Chesterfield.
DEEPFIELDS MILLS, Bilston.
STATION CHAMBERS, Middlesbrough.

The Week's News in Brief

Trade Talk

ELECTROMAGNETS, LIMITED, have removed from 2, Church Street to 48, High Street, Erdington, Birmingham.

THE BLACKHEATH IRONFOUNDRY, LIMITED, is being wound up voluntarily. Mr. N. H. Dixon, Bank Chambers, 313, High Street, West Bromwich, is the liquidator.

THE L.M.S. RAILWAY has placed an order for eight 50-ton bogie bolster trucks with the Fairfield Shipbuilding & Engineering Company, Limited, Chepstow, Mon.

HENRY ROBB, LIMITED, of Leith, have received an order from the Newcastle & Hunter Steamship Company, Sydney, for a steamer to carry cargo and a limited number of passengers.

DURING THE summer meeting of the Institute of Mechanical Engineers at York, members visited the railway works at Doncaster. Mr. H. N. Gresley, chief locomotive engineer of the L.N.E. Railway, and President of the Institute, conducted the party.

THE BUTTERLEY COMPANY, LIMITED, of Derby, have acquired the business in Iron Tri-pedal Paving previously carried on by Iron Paving, Limited. Communications should in future be addressed to the Butterley Company, Limited, Iron Tri-pedal Paving Works, Abbey Road, Park Royal, London, N.W.10.

A NEW IRISH FREE STATE company, to be known as Steele & Company, has been registered with a nominal capital of £3,000, to carry on business as ironfounders and general metal founders. The directors are Messrs. J. B. O'Driscoll, A. Minihan, A. Donnelly and Denis J. Hennessey. Operations will shortly commence at New Ross, County Wexford.

METAL INDUSTRIES, LIMITED, entertained their Scapa staff and workmen at Lyness salvage depôt on the Orkney Island of Hoy to celebrate the raising of the battleship "Kaiserin." The sum of over £1,000 in bonuses was distributed among the 110 salvage workers. Mr. R. W. M'Crone, managing director of the firm and a director of the British Oxygen Company, Limited, presided.

SHEFFIELD FIRMS who have arranged to exhibit at the Empire Exhibition to be held from September, 1936, to January, 1937, at Johannesburg, South Africa, include Edgar Allen & Company, Limited; United Steel Companies, Limited; John Baker & Bessemer, Limited; Thos. Firth & John Brown, Limited; Firth-Vickers Stainless Steels, Limited; Arthur Balfour & Company, Limited, and A. G. Wild & Company, Limited.

THE MECHANICAL INDUSTRY COMMITTEE of the British Standards Institution has recently given consideration to a request received from the management research groups for the standardisation of stores' bins and racks, and it has been agreed that a representative conference of all those concerned shall be held on Friday, June 26, to consider the desirability or otherwise of preparing an appropriate British Standard Specification for these articles.

THE 11-TON BOURDON BELL of the Michigan University carillon has been tested at Loughborough Bell Foundry. The complete carillon has 53 bells and weighs, with the frame, 100 tons. When it is shipped to the United States a representative of J. Taylor & Company will accompany it to superintend the erection. The carillon will be the third largest in the world, and is to be housed in a tower 200-ft. high, at Michigan University. The cost is estimated at £20,000.

UNDER THE NEW Conditions of Employment Act, now in operation in the Irish Free State, all foundry workers must receive an annual holiday of at least a week with full pay, and six public holidays, also with full pay. The Act provides for a 48-hr. week for adults and a 40-hr. week for persons under 18. Young persons cannot start work before eight o'clock and no one under 14 can be employed at industrial work under any circumstances. A licence from the Government is necessary for shift work, and considerable restrictions are placed on overtime. The maximum number of hours for continuous shift work is 56 in any week and in licensed shift work an average of 48 hours in three consecutive weeks.

A PLEA for more unrestricted trade all over the world was made by Lord Londonderry when he performed the opening ceremony of the new spun-iron pipe plant at the Ormesby Ironworks of Cochrane's (Middlesbrough), Limited, on Friday last. The new plant—which will be described in full next week—will produce pipes by means of a new system which enables them to be cast in revolving steel moulds without formation of a "chill" on the outer surface of the metal. The new plant's output is considerably greater than the one it is replacing, and it is understood it will be kept in continuous operation. Following the ceremony, Sir Cecil Cochrane presented Lord Londonderry with a silver cigar box bearing a model of a pipe on the lid.

Contracts Open

Flint, June 29.—Cast-iron water mains, comprising 4,300 yds. 7-in. dia., 1,175 yds. 6-in. dia., 1,440 yds. 5-in. dia., 1,750 yds. 4-in. dia., and 5,700 yds. 3-in. dia., for the Town Council. Williams & Clarke, 6, Godstall Chambers, Chester. (Fee £2 2s., returnable.)

Singapore, August 10.—Spun iron, cast-iron and steel spigot and socket pipes and cast-iron specials, for the Singapore Municipal Water Department. The Department of Overseas Trade. (Reference T.Y. 30,247.)

Stokesley, June 24.—16,000 yds. of 4-in. dia. and 14,000 yds. of 3-in. dia. spun cast-iron pipes, for the Rural District Council. Mr. A. Brooksbank, engineer, 14, The Exchange, Bradford, Yorks. (Fee £2 2s., returnable.)

Tissington, June 23.—1,330 yds. of 3-in. dia. cast-iron pipe. Beevor & Weetman, 43, Bridgegate, Retford, Notts. (Fee £2 2s., returnable.)

Casablanca, July 17.—120-ton crane, for the Director-General of Public Works. The Department of Overseas Trade. (Reference T.Y. 30,319.)

Hanley, June 23.—Two Diesel oil-engine generating sets complete, each set having an output of direct current at 275 kilowatts, for the Staffordshire Potteries Water Board. Mr. P. Wilkinson, engineer, Staffordshire Potteries Water Board, Albion Street, Hanley, Stoke-on-Trent. (Fee £5, returnable.)

Company Reports

Davy Bros., Limited.—Dividend of 5 per cent.

Cannon Iron Foundries, Limited.—Interim dividend of 5 per cent., less tax, on the ordinary shares.

British Oxygen Company, Limited.—Dividend of 3½ per cent. for the half-year ending June 30, on the preference shares.

Whessoe Foundry & Engineering Company, Limited.—Profit, including interest and net profit on investments realised, £30,391; depreciation and special writing off, £5,083; directors' remuneration, £1,961; staff welfare and provident schemes, £1,027; provision for income tax, £4,781; brought in, £3,782; to general reserve, £5,000; dividend of 7½ per cent., £11,437; carried forward, £4,884.

Darwins, Limited.—Profit on trading, including profits of subsidiary companies, interest, etc., £25,197; expenses of management, £6,549; advertising, £7,260; depreciation, £10,043; brought in, £16,698; special expenditure carried forward at March 31, 1935, now written off, £3,000; provision for depreciation of old stock, £2,000; centralisation expenses, £340; provision for income tax not now required, £900; carried forward, £13,603.

Parkinson & Cowan, Limited.—Net profit, after making provision for redemption of debenture stock (£3,468), debenture interest, income tax and depreciation of buildings, etc., £15,114; brought in, £19,175; half-year's preference dividend to September 30, 1934, paid May 31, 1935, £13,126; carried forward, £21,163. In the current year there has been paid to preference shareholders (on March 31, 1936), a dividend for the half-year to March 31, 1935.

Electric Furnace Company, Limited.—Net profit, £24,491; brought in, £955; interim dividend of 3½ per cent. on the cumulative preferred ordinary shares, £2,982; interim dividend of 2½ per cent. on the ordinary shares, £1,951; final dividend of 3½ per cent. on the cumulative preferred ordinary shares, £2,984; final dividend of 4½ per cent. on the ordinary shares, £3,513; general reserve, £7,500; provision in respect of loans without security, £1,570; carried forward, £4,946.

Personal

THE CASE SCHOOL of Applied Science has conferred the honorary degree of Doctor of Engineering on Mr. Harry A. Schwartz.

AMONGST the foreign visitors attending the Glasgow Conference of the Institute of British Foundrymen last week was Mr. H. S. Simpson, the inventor of the Simpson Intensified Sand Mixer, President of the National Engineering Company of Chicago, and a past director of the American Foundrymen's Association. Accompanied by Mrs. Simpson, he has been the guest of Mr. G. E. France (managing director of August's, Limited, of Halifax) and Mrs. France.

Wills

HIGHTON, F. S., former works manager of Robey & Company, Limited, Lincoln	£6,977

Obituary

MR. JOHN BAGNALL, who had been employed at Bamfords, Limited, Leighton Ironworks, Uttoxeter, for 56 years, has died, aged 72 years.

SIR GEORGE HADCOCK, a director of Vickers-Armstrongs, Limited, died on June 4. He was 75. Sir George joined the staff of Sir W. G. Armstrong, Whitworth & Company, Limited, at Elswick Works, Newcastle, in 1889. He was elected to the board of the company in 1915, and later became managing director of the Elswick works. On the fusion of the two firms of Sir W. G. Armstrong, Whitworth & Company, Limited, and Vickers, Limited, in 1928, he was made a director of the new firm of Vickers-Armstrongs, Limited, acting principally in the capacity of technical adviser. In 1918 he was elected a Fellow of the Royal Society. He received the K.B.E. for war services.

MR. W. H. WESSON, J.P., of Moxley, Wednesbury, died on June 8, at the age of 62 years. Mr. Wesson was the eldest son of the late Mr. W. Wesson, who restarted the Victoria Ironworks, Moxley, in 1898. When his father retired from active participation in the control of the works at the age of 81, Mr. Wesson became chairman of W. Wesson & Company, Limited, other directors being his four brothers. He was president of the Wednesbury and District Engineering Society, and was also a strong supporter of the Wednesbury Technical College. He was a member of the Advisory Committee on Production Engineering of the College, and, about two years ago, presented to the college a set of rolls, which came into full use during last session, and are proving of great value. He was appointed a Justice of the Peace in 1933, and was Mayor of Wednesbury for the three years 1926-29.

New Company

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Vauxhall Engineering Company, Limited, Portland House, Church Street, Stoke-on-Trent.—Capital £3,000. To acquire the business of ironfounders, brassfounders and engineers carried on by C. V. Plant and F. Plant as Improved Alloys Company, at Vauxhall Works, Longton, Stoke-on-Trent. Directors: Clarence V. Plant, Frank Plant and Albert C. Hawkins.

Forthcoming Events

JUNE 19.

Keighley Association of Engineers:—Works Visit, British Oxygen Company's Leeds Works, at 6.30 p.m.

JUNE 22-27.

Chemical Engineering Congress, World Power Conference, at Central Hall, Westminster.

JULY 1.

Manchester Association of Engineers:—Works Visits to W. G. Holmes & Company, Limited, and Broadhead & Graves, Limited, of Huddersfield, at 2.15 p.m.

JULY 6-10.

Society of Chemical Industry:—Annual Meeting in Liverpool.

Reavell & Company Ltd

COMPRESSORS & EXHAUSTERS OF ALL TYPES FOR AIR OR GASES

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TELEPHONE Nº 4394 ARDWICK.

BIRMINGHAM OFFICE:
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CONTRACTORS TO
THE ADMIRALTY,
WAR OFFICE, AIR MINISTRY,
INDIA AND HOME OFFICES.

DATE 25th.Feb. 1936.

REFERENCE AGP/EB.

Messrs. Foundry Engineers, Ltd.,
HALIFAX.
Yorks.

Dear Sirs,

In reply to your letter of the 13th.instant, we enclose herewith the two negatives of the Foundry Plant you recently installed for us.

We may say that the Plant continues to give satisfaction and we are obtaining the following output:-

Green Sand	-	25 cwts.	per hour.
Facing Sand	-	25 "	"
Oil Sand.	-	15 "	"

The plant is well ahead of our requirements and is running daily.

Yours faithfully,
REAVELL & CO.LTD

encl.2 negatives.

Raw Material Markets

Conditions in the iron and steel markets continue to be very satisfactory so far as new business is concerned. Deliveries are belated in some areas. Many of the makers are so well sold that they are unable to entertain further commitments. Consumers of pig-iron are endeavouring to obtain as large deliveries as possible before the higher prices come into operation at the beginning of next month.

Pig-Iron

MIDDLESBROUGH. — Despite the recent slight increase in production little relief has been given to the delivery position on the Cleveland market. Stocks, both at the furnaces and the foundries, are negligible and consumers are obliged to use supplies of Midland iron. Current quotations, which will be advanced by 5s. in July, remain unchanged and are purely nominal, Cleveland No. 3 G.M.B. being at 70s. delivered Middlesbrough and Falkirk, 72s. on the North-East Coast, and 73s. on Clyde-side. Offers for any supplies that become available are made at prices in excess of the quotations to operate in July.

Inquiries for supplies of East Coast hematite iron are too large in volume to be satisfied by the current output and deliveries are behind schedule. Prices are on the basis of No. 1 grade at 80s. 6d. for delivery to Northumberland, Durham and North Yorkshire. It is anticipated that these figures will be increased by 5s. in July, on the understanding that buyers who purchase only from associated makers will receive a rebate of 5s.

LANCASHIRE.—Consumers are endeavouring to obtain large deliveries of pig-iron in order to be as well stocked as possible when the higher prices of Midland brands come into force in the near future. New business has not amounted to any substantial tonnage during the past week. Consumption of iron by the machine-tool and light-castings makers is heavy, while the jobbing and general foundries are also well employed. Offers of Staffordshire and Derbyshire brands of No. 3 foundry iron, for delivery to users in the Lancashire zone, are all on the basis of 78s. per ton, with Northants at 76s. 6d. These figures will be higher by 5s. on and after July 1. Scottish foundry iron is quoted at about 89s. 6d. per ton, with West Coast hematite, mixed numbers, at 88s. 6d., and East Coast hematite at 88s., all delivered equal to Manchester.

MIDLANDS.—It is to the credit of the producers that deliveries are on a good scale and they certainly cannot be accused of holding over supplies until after the price increase on July 1. Quotations for delivery before that date are 75s. for Derbyshire, Lincolnshire and North Staffordshire No. 3, and 72s. 6d. for Northants No. 3, with a small rebate to large consumers and inclusive of delivery to Birmingham and Black Country stations. There has been very little new business in the hematite market at the advanced values. However, most users are covered for a considerable period and makers will not receive the benefit of the higher prices until these contracts expire. West Coast mixed numbers are quoted at £4 12s. delivered Birmingham and Black Country stations in 10-ton lots, with East Coast No. 3 at £4 11s. and Welsh mixed numbers at £4 10s. 6d. If delivery into works is required an extra 1s. 6d. per ton is charged. It remains difficult to obtain early deliveries of forge pig-iron, which is quoted at 5s. per ton below No. 3 foundry if required for puddling, but only 3s. per ton less for the foundries. The call for special irons of varying analyses is on a good scale and prices are as follow:—Scottish iron, around 95s.; medium-phosphorus, 80s. to 87s. 6d.; low-phosphorus, 92s. 6d. to 100s.; refined iron, £6 10s. to £7 15s. per ton, according to analysis, delivered this area.

SCOTLAND.—The active conditions in the Scottish market will be interrupted in the middle of July, when the Glasgow Fair holidays are held. Outputs are at full capacity and it is not likely that any addition can be made to these at the present time. The official minimum of No. 3 foundry remains at 79s. at furnaces, with 2s. 6d. extra for No. 1. No. 3 Cleveland iron is quoted at 70s. f.o.t. Falkirk and 73s. f.o.t. Glasgow, but these figures are only nominal, there being no iron available. The Falkirk founders are well employed and they are compelled to take heavy tonnages of Midland iron. Basic iron has changed hands at 75s., delivered, which carries a 5s. rebate. East Coast, West Coast and Scottish hematite is 80s. 6d. f.o.t. steelworks.

Coke

The demand for foundry coke remains on a good scale and prices continue to be firmly maintained, with little possibility of any decrease during the summer months. For delivery in Birmingham and district best Durham coke is quoted at from 41s. 6d. to 43s., with other grades down to 39s. 6d. Welsh coke varies from 39s. up to 50s. per ton, according to quality and analysis.

Steel

Great activity prevails in the steel industry; the recent high rate of production has been maintained and, in some cases, exceeded, says the official report of the London Iron and Steel Exchange. The amount of new business reaching the works has shown a tendency to increase after the spell of quietness which followed the holidays and the advance in prices. There is a considerable volume of inquiry and consumers appear anxious to cover themselves over a long period; but the manufacturers are adopting a cautious attitude and are disinclined to commit themselves. In the semi-finished steel department the situation is more satisfactory and consumers are finding that supplies reach them with greater regularity. There is still difficulty in obtaining prompt delivery of material, but the forward position is distinctly easier. The manufacturers, however, hesitate to accept contracts extending a long time ahead. In the finished steel section of the market business has again become active and the orders taken recently have amounted to a heavy tonnage. Specifications against old contracts are coming forward at a satisfactory rate, and recently there has been a noticeable tendency for the export trade to expand.

Scrap

Further heavy imports of iron and steel scrap have arrived in the Cleveland market and prices have shown a slight downward tendency. Heavy melting steel is the highest priced steel material at 57s. 6d. Heavy cast iron is unchanged at 62s. 6d., with machinery metal at 65s. per ton. All qualities receive active support on the Midland market, and quotations generally are firm. Heavy steel in furnace sizes is at 52s. 6d. to 55s., while mixed heavy iron and steel is at 52s. 6d. Heavy machinery metal in cupola sizes is at 70s., good, heavy pipe and plate at 65s., and clean light at 52s. 6d. to 55s. Short, heavy steel, suitable for use in the foundries, is at 70s. per ton, delivered works. Rather quiet conditions prevail on the Scottish market at the present time and, with large supplies of imported material awaiting sale, there is little call for home-produced scrap. Heavy steel scrap is at 57s. 6d., and heavy basic, or heavy iron and steel scrap mixed, at 52s. 6d. Heavy machinery cast-iron scrap is quiet at 70s., for material of first-class quality and in pieces not exceeding 1 cwt. Ordinary heavy cast iron, to the same specification, is 67s., with light cast-iron scrap at 47s. 6d. to 50s. per ton, delivered f.o.t. consumers' works.

Metals

Copper.—Very little buying interest has been shown in this market during the past week and conditions generally are dull. French consumption has dropped sharply, owing to the strikes. The market in the United States is also quiet, but deliveries against existing contracts are on a good scale and consumption is heavy. The American Bureau of Metal Statistics gives the domestic consumption of copper in the United States during 1935 as 567,000 short tons, as compared with 467,000 tons in 1934. The world's consumption during 1935 is estimated at 1,795,578 short tons, against 1,498,136 tons in the previous month. World stocks of refined copper at the end of May fell to 466,100 tons, according to a New York report. This represents a decline on the month of 4,900 tons. The apparent world consumption for the month totalled 138,800 tons.

Daily market prices :—

Cash.—Thursday, £36 1s. 3d. to £36 2s. 6d.; Friday, £36 5s. to £36 6s. 3d.; Monday, £36 3s. 9d. to £36 5s.; Tuesday, £36 2s. 6d. to £36 3s. 9d.; Wednesday, £36 5s. to £36 6s. 3d.

Three Months.—Thursday, £36 7s. 6d. to £36 8s. 9d.; Friday, £36 10s. to £36 12s. 6d.; Monday, £36 8s. 9d. to £36 11s. 3d.; Tuesday, £36 7s. 6d. to £36 10s.; Wednesday, £36 10s. to £36 12s. 6d.

Tin.—There has been little change in the general tone of this market, which remains weak. There has been a moderate demand in this country, but quiet conditions have prevailed in the United States, although, at times, increased buying has been noticeable. It is expected that similar conditions will continue until after the next meeting of the International Tin Committee on June 25.

Metal Exchange quotations were as follow :—

Cash.—Thursday, £184 15s. to £185; Friday, £185 10s. to £185 15s.; Monday, £181 to £181 15s.; Tuesday, £181 to £181 5s.; Wednesday, £180 10s. to £180 15s.

Three Months.—Thursday, £182 15s. to £183; Friday, £183 5s. to £183 10s.; Monday, £179 to £179 5s.; Tuesday, £179 15s. to £180; Wednesday, £178 15s. to £179.

Spelter.—The brass, rolling and galvanising industries are taking up considerable tonnages of metal. Otherwise this market is dull, with prices at the lowest level of the year. There is little improvement in the United States market and new buying is of small consequence. It is thought that consumers' stocks must be low and that they will be forced back into the market in the near future. The world production of zinc in 1935, according to the American Bureau of Metal Statistics, was 1,349,350 metric tons, against 1,183,938 tons in 1934. Consumption was 1,351,100 metric tons and 1,158,500 tons respectively.

Official quotations were as follow :—

Ordinary.—Thursday, £14 2s. 6d.; Friday, £14; Monday, £13 15s.; Tuesday, £13 13s. 9d.; Wednesday, £13 8s. 9d.

Lead.—Buying has not involved any substantial tonnage recently and the market is featureless. The American Bureau of Metal Statistics gives the world's consumption of lead in 1935 as 1,426,700 metric tons, which compares with 1,344,400 tons in 1934.

Day-to-day quotations :—

Soft Foreign (Prompt).—Thursday, £15 3s. 9d.; Friday, £15 3s. 9d.; Monday, £15; Tuesday, £15; Wednesday, £15 1s. 3d.

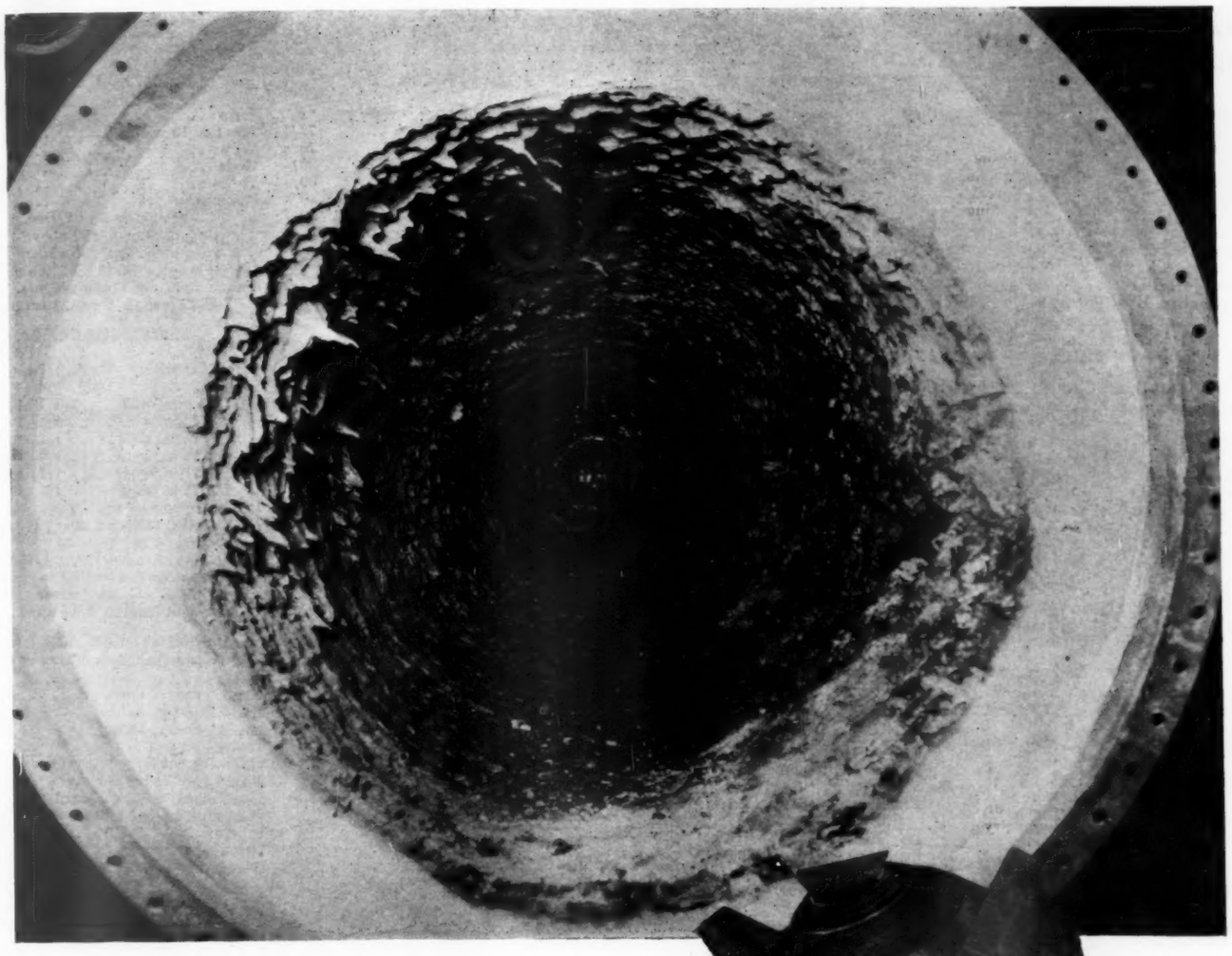
Ford's New Control Laboratory

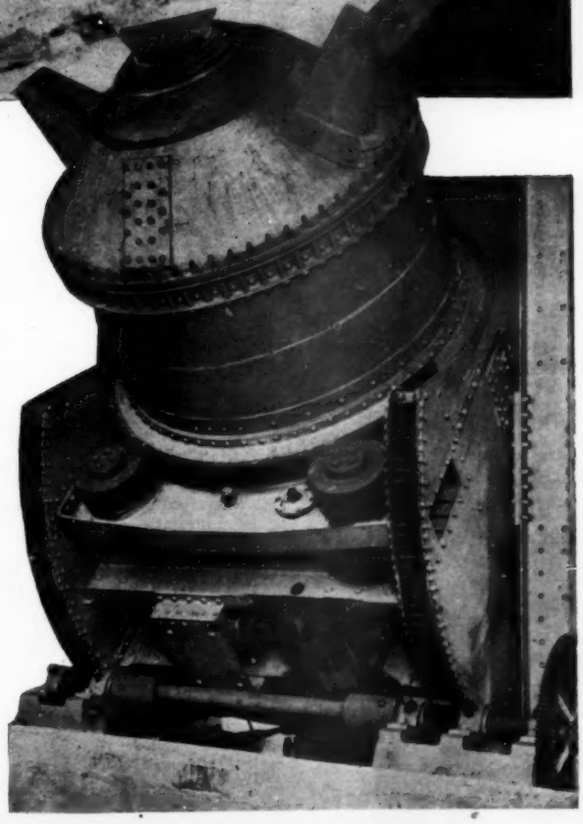
A new chemical and metallurgical testing and production control laboratory has been placed in service by the Ford Motor Company at the Rouge plant at Dearborn, Mich., and is now working on a 24-hour day basis, states the "Iron Age." It is used to analyse the molecular structure of steels, to determine the physical properties of metals and fabricated parts, and to analyse steels, irons and other metals; textiles, paints, oils, and rubbers used in the factory.

Included in the equipment is a new X-ray machine having an oil-cooled fine focus radiographic tube of 230,000-volt capacity. It has sufficient intensity to penetrate 4 in. of steel, and through its use flaws less than 2 per cent. of total thickness are detected. Its intensity permits a great time-saving in making X-ray photographs. A crankshaft, for example, can be photographed in about 3 min. The X-ray department also includes a diffraction machine equipped with a new tube which will obtain in 20 minutes pictures which formerly required from 24 to 70 hours of exposure. The machines are used largely in research to improve casting and steel treating technique through a study of the atomic structure of the finished steels and alloys.

Another new instrument in the laboratories is the profilograph, used to examine steel finishes. Through an optical magnifying system, any imperfections in the finish are detected by a diamond point and magnified 2,000 times vertically and 64 times horizontally. Thus the graph of a surface of a $\frac{1}{2}$ in. specimen of steel becomes a readable chart 8 in. long, with minute irregularities showing as deep ridges.

Well-equipped developing and printing rooms adjoin the X-ray and metallographic rooms. In the analytical laboratory, all work tables are of stainless nickel-chrome steel, and furnaces and other apparatus are of the latest improved type. A staff of 65 technicians is employed.





930 tons of metal melted—

The above photograph shows the condition of an 04 grade Albino lining in a 5-ton Brackelsberg furnace after 255 heats, which melted 930 tons of metal. You will observe the lining has worn evenly and it is still approximately 8″ in thickness. The 04 grade is specially produced for rotary furnaces, but there are other grades for lining cupolas, converters and ladles.

These photographs are reproduced by courtesy of James Howden and Company (Land), Ltd.

ALBINO

Rotary Furnace Lining Material

Please write for further particulars to the sole manufacturers:—

GENERAL REFRACTORIES LIMITED,

Genefax House, Sheffield 10.

Telephone: Sheffield 31113 (6 *lines*). *Telegrams: "Genefax Sheffield."*

MANUFACTURERS OF HEAT RESISTING AND HEAT INSULATING MATERIALS OF EVERY DESCRIPTION.

RAW MATERIALS—PRICE LIST

(Wednesday, June 17, 1936)

COPPER

	£ s. d.
Standard cash	36 5 0
Three months	36 10 0
Electrolytic	40 5 0
Tough	38 15 0
Best selected	39 5 0
Sheets	68 0 0
India	49 12 6
Wire bars	40 10 0
Ingot bars	40 10 0
H.C. wire rods	44 2 6
Off. av. cash, May	36 14 6¾
Do., 3 mths., May	37 0 2½
Do., Sttlmnt., May	36 14 6¾
Do., Electro, May	41 0 8½
Do., B.S., May	40 9 2
Do., wire bars, May	41 4 7½
Solid drawn tubes	10½d.
Brazed tubes	10¾d.
Wire	6½d.

BRASS

Solid drawn tubes	9½d.
Brazed tubes	11¼d.
Rods, drawn	8¾d.
Rods, extd. or rlld.	8d.
Sheets to 10 w.g.	8d.
Wire	7¼d.
Rolled metal	7⅞d.
Yellow metal rods	5d.
Do. 4 × 4 Squares	5¼d.
Do. 4 × 3 Sheets	5¼d.

TIN

	£ s. d.
Standard cash	180 10 0
Three months	178 15 0
English	180 10 0
Bars	181 10 0
Straits	182 10 0
Australian (nom.)	—
Eastern	181 0 0
Banca	182 10 0
Off. av. cash, May	202 12 1½
Do., 3 mths., May	197 4 4½
Do., Sttlmt., May	202 12 4½

SPELTER

	£ s. d.
Ordinary	13 8 9
Remelted	13 5 0
Hard	10 15 0
Electro 99.9	15 11 3
English	14 15 0
India	12 5 0
Zinc dust	19 10 0
Zinc ashes	4 5 0
Off. aver., May	14 13 1½
Aver. spot, May	14 10 8½

LEAD

	£ s. d.
Soft foreign ppt.	15 1 3
Empire	15 15 0
English	17 0 0
Off. average, May	15 11 3½
Average spot, May	15 10 7½

ALUMINIUM

Ingots	£100 to £105
Wire	1/3 to 1/4 lb.
Sheet and foil	1/2 to 1/4 lb.

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	24 10 0 to 25 0 0
Do., V.M. ex-whse.	24 10 0 to 25 0 0
Rods	26 0 0

ANTIMONY

	£ s. d.
English	66 10 0 to 67 10 0
Chinese, ex-whse.	55 0 0
Crude, c.i.f.	25 0 0

QUICKSILVER

	£ s. d.
Quicksilver	11 15 0 to 12 5 0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	12 15 0
75%	17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
20/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£21 0 0 to £22 0 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	33 0 0
4/6% car.	21 10 0
6/8% car.	21 0 0
8/10% car.	21 0 0
Ferro-chrome—	
Max. 2% car.	33 10 0
Max. 1% car.	36 5 0
Max. 0.70% car.	37 5 0
70% carbon-free	9½d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	6/3 to 6/9 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£11 5 0 to 11 15 0
76/80% packed	£12 5 0 to 12 15 0
76/80% export	(nom.) £10 5 0
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated, basis 2-ton lots.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to $\frac{1}{16}$ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£ s. d.	£ s. d.
South Wales—		
Heavy steel	3 3 0	to 3 4 0
Mixed iron and steel	2 19 0	to 3 0 0
Heavy cast iron	2 18 0	to 3 0 0
Good machinery	3 2 6	to 3 5 0
Cleveland—		
Heavy steel	2 17 6	
Steel turnings	2 0 0	
Heavy cast iron	3 2 6	
Heavy machinery	3 5 0	
Midlands—		
Light cast-iron scrap	2 12 6	to 2 15 0
Heavy wrought iron	3 7 6	to 3 10 0
Steel turnings	2 2 6	
Scotland—		
Heavy steel	2 17 6	
Ordinary cast iron	3 7 0	
Engineers' turnings	2 2 6	
Cast-iron borings	1 17 6	
Wrot-iron piling	3 10 0	
Heavy machinery	3 10 0	

London—Merchants' buying prices, delivered yard.

	£ s. d.
Copper (clean)	29 0 0
Brass	19 0 0
Lead (less usual draft)	14 0 0
Tea lead	9 0 0
Zinc	9 0 0
New aluminium cuttings	74 0 0
Braziery copper	26 0 0
Gunmetal	27 0 0
Hollow pewter	145 0 0
Shaped black pewter	108 0 0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	72/6
,, No. 3	70/-
,, No. 4	69/-
Forge No. 4	69/-
Hematite No. 1	80/6
Hematite M/Nos.	80/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	80/6
,, d/d Birm.	92/-
Malleable iron d/d Birm.	125/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	72/-
,, No. 3 fdry.	75/-
Northants forge	69/6
,, fdry. No. 3	72/6
,, fdry. No. 1	75/6
Derbyshire forge	72/-
,, fdry. No. 3	75/-
,, fdry No. 1	78/-
Scotland—	
Foundry, No. 1, f.o.t.	81/6
,, No. 3, f.o.t.	79/-
Cleveland No. 3, Glasgow	73/-
,, ,, Falkirk	70/-
Scottish hem. M/Nos. d/d	80/6
Sheffield (d/d district)—	
Derby forge	69/6
,, fdry. No. 3	72/6
Lincs forge	69/6
,, fdry. No. 3	72/6
W.C. hematite	86/-
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	78/-
Staffs fdry. No. 3	78/-
Northants fdry. No. 3	76/6
Cleveland fdry. No. 3	78/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	89/6
Clyde, No. 3	89/6
Monkland, No. 3	89/6
Summerlee, No. 3	89/6
Eglinton, No. 3	89/6
Gartsherrie, No. 3	89/6
Shotts, No. 3	89/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

	£ s. d.	£ s. d.
Iron—		
Bars (cr.)	10 2 6	
Nut and bolt iron	8 10 0	to 9 0 0
Hoops	11 0 0	and up.
Marked bars (Staffs) f.o.t.	12 10 0	
Gas strip	11 0 0	and up.
Bolts and nuts, ½ in. × 4 in.	15 15 0	and up.
Steel—		
Plates, ship, etc.	9 7 6	to 9 10 0
Boiler plts.	9 17 6	to 10 0 0
Chequer plts.	11 0 0	
Angles	9 0 0	
Tees	10 0 0	
Joists	9 7 6	
Rounds and squares, 3 in. to 5½ in.	10 0 0	
Rounds under 3 in. to ⅛ in. (Untested)	9 7 0	
Flats—8 in. wide and over	9 5 0	
,, under 8 in. and over 5 in.	9 10 0	
Rails, heavy	8 5 0	to 8 10 0
Fishplates	12 10 0	
Hoops (Staffs)	10 2 0	
Black sheets, 24g. (4-t. lots)	11 10 0	
Galv. cor. shts. (,,)	13 10 0	
Galv. flat shts. (,,)	14 0 0	
Galv. fencing wire, 8g. plain	15 0 0	
Billets, soft	6 2 6	and up.
Billets, hard	7 2 6	to 7 7 6
Sheet bars	6 0 0	to 6 5 0
Tin bars	6 0 0	to 6 5 0

PHOSPHOR BRONZE

	Per lb. basis
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	12½d.
Rods	11½d.
Tubes	14d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	21.31
No. 2 foundry, Valley	19.50
No. 2 foundry, Birm.	15.50
Basic, Valley	19.00
Malleable, Valley	19.50
Grey forge, Valley	19.00
Ferro-mang. 80%, seaboard	75.00
O.-h. rails, h'y, at mill	36.37½
Billets	28.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.85
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.80
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.10
Plain wire	2.40
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	30/- to 31/-
,, furnace	24/- to 26/-
Durham foundry	25/- to 26/-
,, furnace	22/6
Scotland, foundry	30/-
,, furnace	25/- to 26/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes 20×14 per box	18/9
,, 28×20 ,,	37/6
,, 20×10 ,,	27/-
,, 18¾×14 ,,	19/6
C.W. 20×14 ,,	15/9 to 16/3
,, 28×20 ,,	34/3
,, 20×10 ,,	23/-
,, 18¾×14 ,,	15/9 to 16/3

SWEDISH CHARCOAL IRON & STEEL

	£ s. d.	£ s. d.
Pig-iron	£6 0 0	to £7 0 0
Bars-hammered, basis	£16 0 0	to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0	to £16 0 0
Blooms	£10 0 0	to £12 0 0
Keg steel	£30 0 0	to £31 0 0
Faggot steel	£18 0 0	to £23 0 0
Bars and rods dead soft, st'l	£10 0 0	to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£	s.	d.		
June 11 ..	36	1	3	No	change
„ 12 ..	36	5	0	inc.	3/9
„ 15 ..	36	3	9	dec.	1/3
„ 16 ..	36	2	6	„	1/3
„ 17 ..	36	5	0	inc.	2/6

Electrolytic Copper

	£	s.	d.		
June 11 ..	40	0	0	dec.	7/6
„ 12 ..	40	5	0	inc.	5/-
„ 15 ..	40	2	6	dec.	2/6
„ 16 ..	40	2	6	No	change
„ 17 ..	40	5	0	inc.	2/6

Standard Tin (cash)

	£	s.	d.		
June 11 ..	184	15	0	inc.	25/-
„ 12 ..	185	10	0	„	15/-
„ 15 ..	181	0	0	dec.	90/-
„ 16 ..	181	0	0	No	change
„ 17 ..	180	10	0	dec.	10/-

Tin (English ingots)

	£	s.	d.		
June 11 ..	184	15	0	inc.	25/-
„ 12 ..	185	15	0	„	20/-
„ 15 ..	181	10	0	dec.	85/-
„ 16 ..	181	0	0	„	10/-
„ 17 ..	180	10	0	„	10/-

Spelter (ordinary)

	£	s.	d.		
June 11 ..	14	2	6	No	change
„ 12 ..	14	0	0	dec.	2/6
„ 15 ..	13	15	0	„	5/-
„ 16 ..	13	13	9	„	1/3
„ 17 ..	13	8	9	„	5/-

Spelter (Electro, 99.9 per cent.)

	£	s.	d.		
June 11 ..	16	5	0	No	change
„ 12 ..	16	2	6	dec.	2/6
„ 15 ..	15	17	6	„	5/-
„ 16 ..	15	16	3	„	1/3
„ 17 ..	15	11	3	„	5/-

Lead (soft foreign, prompt)

	£	s.	d.		
June 11 ..	15	3	9	dec.	2/6
„ 12 ..	15	3	9	No	change
„ 15 ..	15	0	0	dec.	3/9
„ 16 ..	15	0	0	No	change
„ 17 ..	15	1	3	inc.	1/3

Lead (English)

	£	s.	d.		
June 11 ..	17	5	0	dec.	5/-
„ 12 ..	17	5	0	No	change
„ 15 ..	17	0	0	dec.	5/-
„ 16 ..	17	0	0	No	change
„ 17 ..	17	0	0	„	„

AVERAGE MONTHLY PRICES OF STEEL BOILER PLATES IN ENGLAND

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1899	7 5 0	8 0 0	8 2 6	8 2 6	8 5 0	8 5 0	8 12 6	8 12 6	8 15 0	8 15 0	9 2 6	9 5 0	8 17 8½
1900	9 5 0	9 5 0	9 7 6	9 10 0	9 12 6	10 5 0	10 5 0	10 5 0	10 5 0	10 0 0	9 15 0	9 15 0	9 15 10
1901	9 5 0	9 5 0	8 15 0	8 10 0	8 10 0	7 10 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 3 11
1902	7 7 6	7 0 0	7 12 6	7 12 6	7 12 6	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 9 7
1903	7 10 0	7 10 0	7 15 0	7 5 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	6 17 6	7 3 11½
1904	6 12 6	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 11½
1905	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 10 0	7 5 0	8 0 0	8 0 0	7 1 3
1906	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 0 10
1907	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 8 4
1908	7 10 0	7 10 0	7 10 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 3 9
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 15 0	6 15 0	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 9
1910	7 0 0	7 0 0	7 1 3	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 10 0	7 10 0	7 10 0	7 5 1
1911	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 14 0	7 10 4
1912	7 18 9	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 15 0	8 16 3	9 0 0	9 2 0	9 5 0	8 11 2½
1913	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	8 19 0	8 15 0	8 5 0	7 15 0	7 15 0	8 17 0
1914	7 15 0	7 15 0	7 15 0	7 13 9	7 10 6	7 5 0	7 0 0	8 0 0	8 2 6	8 5 0	8 5 0	8 5 0	7 15 11½
1915	8 14 0	9 10 0	9 17 6	10 10 0	10 10 0	11 0 0	11 0 0	11 0 0	11 0 0	11 4 0	12 0 0	13 0 0	10 15 5½
1916	13 0 0	13 0 0	13 0 0	12 15 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 12 11
1917	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1918	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1919	13 0 0	15 0 0	15 0 0	15 0 0	19 5 0	19 17 6	21 0 0	21 10 0	21 10 0	21 10 0	21 15 0	23 10 0	18 9 9
1920	26 0 0	28 0 0	28 5 0	28 10 0	29 5 0	30 0 0	30 0 0	30 0 0	30 10 0	31 0 0	31 0 0	31 0 0	29 9 2
1921	30 5 0	29 0 0	25 0 0	25 0 0	25 0 0	23 0 0	21 0 0	20 10 0	19 0 0	17 10 0	16 0 0	14 16 0	22 1 9
1922	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	13 1 8	13 10 0	12 15 0	12 10 0	12 10 0	12 10 0	12 6 0	13 10 9
1923	12 8 9	13 6 0	14 0 0	14 0 0	14 0 0	14 0 0	13 12 6	13 0 0	13 0 0	13 0 0	13 0 0	13 10 0	13 9 1½
1924	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	14 0 0	14 0 0	13 11 0	13 5 0	13 5 0	13 10 11
1925	13 5 0	13 5 0	13 5 0	13 1 0	12 15 0	12 15 0	12 15 0	12 15 0	12 7 6	11 14 0	11 10 0	11 10 0	12 11 5½
1926	11 10 0	11 10 0	11 10 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 6 3
1927	11 5 0	11 5 0	11 5 0	11 5 0	11 2 6	11 0 0	11 0 0	11 0 0	10 16 0	10 10 0	10 10 0	10 10 0	10 19 0½
1928	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0
1929	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 5 0	10 1 3	10 1 3	10 1 3	10 1 7	10 6 8½
1930	10 2 9	10 3 5½	10 3 9	10 3 6	10 3 6	10 2 6	10 2 6	10 2 2½	9 19 6	9 16 3	9 16 3	9 16 3	10 1 6½
1931	9 15 0	9 15 0	9 15 0	9 10 11	9 6 9	9 5 0	9 7 0	9 7 9½	9 8 9	9 5 9	9 5 6	9 9 6	9 9 4
1932	9 5 0	9 2 6	8 18 6	8 17 6	8 16 6½	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 17 10
1933	8 10 0	8 10 0	8 10 0	8 8 9	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 6 0	8 7 6	8 6 10½
1934	8 8 1½	8 10 7½	8 16 6	8 17 6	8 6 3	8 6 3	8 5 7½	8 5 0	8 5 0	8 5 0	9 6 3	9 6 3	8 11 6½
1935	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3
1936	9 6 3	9 6 3	9 6 3	9 6 3	9 9 4½	—	—	—	—	—	—	—	—

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